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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 7 FEBRUARY, 1928 NUMBER 2

ABSCESS OF THE LUNG

MEDICAL ASPECT *

THOMAS McCRAE, M.D., F.R.C.P. (LOND.)

PHILADELPHIA

The teamwork so essential in the solving of many problems is essential in the solution of some of the problems of abscess of the lungs, partly in treatment but perhaps more so in prevention. Laryngologists do not generally agree as to the best therapy, and certainly one is in the dark as to the etiology in many cases. The solution of some of the problems rests largely in the laryngologist's hands.

It seems more useful to discuss some of these obscure points than to dwell on what may be described as the strictly medical aspect of the problems of abscess of the lungs. To the internist the problem of diagnosis, before rupture has occurred into a bronchus or into the pleura, offers great interest and also great difficulty, but laryngologists are not specially concerned with this side of the problem. The etiology and treatment are their particular interests, the former especially because it is so closely connected with the question of prevention.

ETIOLOGY

In certain cases the etiology is absolutely clear, such as abscess due to a foreign body in a bronchus or secondary to a bronchial neoplasm. The same may be said of abscess which follows pneumonia or accompanies pulmonary tuberculosis. There are cases in which it is clearly evident that infarction is responsible. But beyond these, there are certain cases in which a cause cannot be positively established. Of particular interest are the cases in which abscess of the lungs has followed some operative procedure on the upper air passages and, most particularly, tonsillectomy. How often does this occur? It is not possible to speak with certainty, because undoubtedly many of the cases are not attributed to the proper cause. The internist sees this demonstrated by patients who are admitted to his wards with abscess of the lungs following tonsillectomy, but who do not associate the two events. Certainly the day has gone by when any physician who has performed a considerable number of tonsillectomies has the right to state that abscess of the lung has never followed any tonsillectomy that he has done. It may be granted that he may not know of them, but they have occurred just the same. I would suggest in

* Read at the Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 24, 1927.

regard to this that every patient who is discharged following tonsillectomy should be instructed to return at once if there should be any evidence of thoracic disease within three months. Cough is the symptom most likely to attract attention and should be specifically mentioned.

Exact determination of the frequency of abscess of the lungs after tonsillectomy should be possible as well as a solution of the relative incidence under various forms of anesthesia, technical details, etc. It should be possible to collect a great many data, but to be of value they should be strictly accurate and represent careful "follow-up work."

Are there any factors which may bear on the occurrence of abscess of the lungs? There is no doubt that the condition of the patient at the time of operation may play a part. Here is one of the difficulties of the problem. Tonsillectomy is performed frequently, often with great pressure on the resources of the clinic, so that patients are hurried in and hurried out as rapidly as possible. Under these conditions, how careful a study is made of the patient before operation? No one is going to operate on a patient whom he knows has some acute infection of the respiratory tract, but how careful is one to obtain the information? No doubt there is a tremendous difference in many clinics, and some are beyond reproach. That all can be put in this class may be questioned. This seems a point worthy of careful attention, even with the realization that a careful study, especially of the respiratory tract, before operation adds greatly to the routine work. Another reason for a careful study of the respiratory tract, in addition to the recognition of an acute infection, is for the recognition of pulmonary tuberculosis. It is true that many patients who come to the medical wards with an acute lighting up of a tuberculous process date this to a tonsillectomy. The same point applies to the tendency in some clinics to hurry the patients out at the earliest possible moment. How much this adds to the frequency of subsequent complications it is difficult to say, but it is not right from either a surgical or a medical standpoint. However, the operator may regard tonsillectomy, my view as an internist is that considerable danger attaches to it, and that it should not be regarded lightly.

Mechanical factors have to be considered as well. After a forcible cough with strong expiration, a strong inspiration follows which must tend to carry any material in a bronchus to lower levels in the lung. If one abolishes the cough reflex, is one aiding the patient or not? The determination of this point is important. Is the administration of morphine before operation proper or improper? How correct is it to give sedatives after operation?

What about the organisms in the abscess cavity? The problem of spirochetes in the pus is in doubt. Are they merely accidental invaders after the abscess has ruptured into a bronchus, or are they of etiologic importance? Careful study of the first pus that is expelled and study of

the contents of the abscess obtained through the bronchoscope as soon as possible after rupture should be of value. All laryngologists have seen cases in which the pus contained large numbers of spirochetes and in which the administration of neoarsphenamine seemed to be of value. In other cases, it did not have any effect. A decision as to the value of arsenical treatment is important. It should not be given unless it is of use. Along the same line is the question of the local application of neoarsphenamine to the abscess cavity if spirochetes are present. Is this useful? The answer to these questions demands extensive study.

CLINICAL FEATURES

For the internist, the problem of diagnosis before rupture is perhaps the most important aspect. A definite picture cannot be drawn, as the size and position of the abscess, along with other conditions present, may give a great variety of symptoms. To think of the possibility is often of the greatest aid in diagnosis. An early recognition of the cause may mean early treatment if external drainage is indicated, but this treatment means surgical intervention. However, a failure of diagnosis may deprive the patient and the surgeon of the best chances to lessen the danger.

PROGNOSIS

Many factors influence the prognosis, but, essentially, the condition is always serious. A definite separation must be made between the abscesses which are due to a foreign body and those which arise under other conditions. One of the most surprising and pleasing things in therapy is to see the rapid improvement in an abscess due to a foreign body after the foreign body is removed. In other cases, much depends on the situation of the abscess, its extent and the resistance of the patient. But the possibility of early skilled bronchoscopic drainage is, in my opinion, one of the most important single points. After watching many of these patients, I have this conclusion firmly fixed in my mind.

TREATMENT

There cannot be a set rule in regard to treatment, and it is on the careful study of the individual patient that so much depends. Before rupture occurs into a bronchus, the problem of external drainage must be decided. Naturally this question arises in treating patients with abscesses near the periphery of the lung. Much depends on early diagnosis, and here the burden rests on the physician. If he does not suspect the possibility of abscess or of some local lesion, the roentgenologist does not have the opportunity of making a study or the surgeon the chance of an early decision as to operation. With the improvement in technic in operations on the lungs, it seems fair to hope that more early operations for drainage will be performed.

Bronchoscopic Drainage. — When rupture has occurred into a bronchus, bronchoscopic drainage is without question the treatment to be tried first. In my judgment, the earlier it is begun the better it is for the patient. Emphasis should be placed on this, as the value of bronchoscopy in abscess of the lungs gain recognition slowly. In a textbook of medicine published recently, mention is not made of it in the treatment of acute abscess; it is mentioned in the treatment of chronic abscess, in which its value, although great, is less evident. The details of bronchoscopic drainage and the use of applications are not in my province to discuss. The intervals between drainages must be decided for each patient. In early acute cases, it would seem wise to do it at as short intervals as possible for a time.

The question of the significance of spirochetes in the contents of the abscess was mentioned. When they are found, should neoarsphenamine be given? This seems worth a trial, and the result should decide whether it is to be continued or not.

Postural Drainage.—Postural drainage should always be carried out as thoroughly as possible. A careful study should be made of the best method for each patient. A considerable amount of encouragement from the physician and perseverance in the patient are often required.

Drugs.—How much aid may be obtained from drugs? Creosote is usually worth a trial in chronic abscess and should be given in full dosage by mouth or by inhalation. In the latter method, it may be given by an inhaler or by vaporization and inhalation of the fumes by the method sometimes used for bronchiectasis.

Pneumothorax.—It is difficult to speak with certainty regarding pneumothorax. Its value is unquestionable in some cases, and undoubtedly it sometimes does much harm. Perhaps the unsuccessful results have come particularly to my attention. With the collapse of the lung the bronchus may be completely closed, as has been demonstrated by bronchoscopy, and drainage stopped—an undesirable result. Certainly pneumothorax should be used only after the greatest consideration and after bronchoscopic drainage has been given a thorough trial.

Bronchiectasis.—That patients with advanced bronchiectasis can be aided by bronchoscopic drainage is abundantly proved. It is to be hoped that something may be done by early recognition and drainage at an early stage to lessen the serious late results. In bronchiectasis, the physician must make an early diagnosis so that the bronchoscopist can have his chance to help. In some cases, probably a few, a local process other than a foreign body which causes obstruction in a bronchus may be responsible. If this can be recognized early and the patients treated some may be saved from the fate of chronic bronchiectasis. In the opportunity to do this, one is dependent on the internist for early recognition of the condition.

SUPPURATION OF THE LUNG

SURGICAL ASPECT *

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There is no other region of the human body in which the sister sciences, internal medicine and surgery, together with some of their offspring, the specialties, are called on to cooperate more intimately in diagnosis and therapy than within the thorax.

To the laryngologist those of the organs located in the thorax which are accessible from the outside, viz., the lungs through the trachea and bronchi, and the stomach, cardia and esophagus by way of the esophagus, are of special interest at the present time and therefore call for consideration and discussion. The peroral endoscopist introduces his ingenious instruments into the trachea and the bronchi, and into the esophagus; by way of the latter tubes he participates in the treatment of diseases of the organs mentioned.

As suppuration of the lung was the topic selected for today's symposium, the esophagus is excluded from consideration. Even so, the subject open for discussion remains so extensive that only by strong condensation can it be fully encompassed, from the surgical point of view, within the scope of this paper.

ETIOLOGY

The various causes of suppuration of the lung are the same as those of suppuration in any other part of the body. They are:

1. Traumatism, including the entrance of a foreign body into the bronchial tree, in this particular instance either by aspiration, or from without directly into the parenchyma of the lung by means of violence (a bullet, a knife or dagger, a piece of broken rib, etc.). If the all-inclusive term "foreign substance" is substituted for "foreign body," then one covers at once all the various possibilities, namely, solid, semisolid and liquid foreign substances, the latter two being represented by stomach contents, mucopus and blood, and infected water, while in swimming.

2. The entrance of infecting microbes, such as the pneumococcus, streptococcus or staphylococcus, or the influenza bacillus, also spirillae. These organisms produce an acute inflammation and thereby become the cause of the onset of subacute and chronic nonspecific suppuration of the lung.

3. Chronic specific inflammation—tuberculosis and syphilis.

4. Ulcerating tumors.

5. The rather rare purulent inflammations following suppurating hydatid of the lung, actinomycosis, etc.

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* Read at the annual meeting of the American Laryngological Association, Atlantic City, N. J., May 24, 1927.

It would lead too far afield to enter into the consideration of the types of suppuration mentioned under 3, 4 and 5, though not infrequently, as far as ulcerating neoplasms are concerned, the bronchoscopist alone is the specialist who can establish the correct diagnosis in a case of obscure chronic purulent expectoration. By one glance he may find, for instance, a sessile growth of the wall of the bronchus and, with the help of biopsy, place a specimen of the growth in the hands of the pathologist for classification.

Besides the acute severer inflammations, like pneumonia, influenza and spirillar infection of the lung, aspiration of a foreign substance certainly is the principal cause of suppuration of the lung, the next in the order of frequency being embolism by an infected thrombus. It depends on the virulence of the causative element in either case whether an acute malignant gangrene will develop.

TYPES OF SUPPURATION OF THE LUNG

In order to facilitate the more ready recognition of the type of the prevailing suppuration and in order to make it thereby easier for the surgeon to advise the best treatment in the given case, it appears wise to me to differentiate as follows:

1. Typical bronchiectasis, which shows honeycomb-like, multilocular diffuse suppuration of one or more lobes of the lung.

2. Bronchiectatic abscess of the lung, which represents local gangrene as a consequence of aspiration and localized infected embolism.

3. The ordinary abscess of the lung as it usually occurs subsequent to pneumonia, influenza, spirillosis, etc., and infecting traumatism.

DIAGNOSIS

With a patient before him suffering from suppuration of the lung, the surgeon does not primarily think of operation. His thoughts turn to the fixation of a "refined diagnosis" and strict indication. At the Lenox Hill Hospital of New York City, the following procedure is followed: The history of the case is carefully taken; it shows a great deal that it is necessary to know, such facts as a former acute inflammatory condition, like pneumonia or influenza; the possibility of the presence of a foreign substance that was aspirated into the bronchial tree, etc., important points in rough classification. On the basis of such data, the surgeons of the division will quickly form an opinion as to the type of suppuration with which they have to deal. While the bacteriologist of the laboratory examines the sputum and classifies the cultures obtained and the serologist investigates the blood, the roentgenologist meets the attending surgeon and his staff and discusses with them the interpretation of the films.

As soon as all data are assembled, the internist is called into consultation. Then the patient is turned over to the bronchoscopic department.

This, of course, is done only in cases of subacute and chronic forms of the disease; in the fulminant forms, particularly those of acute gangrene of the lung, time is not lost in bringing such prompt surgical help as may be required.

The bronchoscopist now localizes still more definitely the seat of the suppuration and determines whether one or more lobes are involved—from the point of precision, he certainly is the best equipped to do so—and gives the patient regular intrabronchial treatment, if he thinks this will be effective. At the same time, an attempt is made to support the work of the bronchoscopist by reducing or removing the foul odor of the sputum by means of intravenous injections of neoarsphenamine, as suggested by David Smith, of Raybrook.

As mentioned before, the virulent, fortunately rare, forms of acute septic inflammation of a greater portion of a pulmonary lobe, with fulminant gangrene, so often due to aspiration of stomach contents in the course of general anesthesia, are, of course, purely surgical from the start. Milder forms of this type are well amenable to the work of the bronchoscopist.

TREATMENT

(*a*) *By the Bronchoscopist.*—Early treatment, perhaps better termed prophylactic treatment, is of the utmost importance in beginning suppuration of the lung due to aspiration. This prophylactic treatment consists of—besides forced active expectoration in the pronounced knee-elbow posture several times in the course of the day, so-called posture treatment—bronchoscopy with or without thorough, painstaking aspiration, often intrabronchial treatment also, at as early a date as possible, whether or not the patient is deathly sick with chills and high fever, continuous cough and foul sputum; for, naturally, the sooner the foreign substance is removed, the better for the patient. In that respect bronchoscopy, no doubt, is superior to artificial pneumothorax. To my mind the latter, which, though it is efficient also in this class of cases, is to be resorted to only after repeated bronschoscopic suction with intrabronchial treatment has failed. After all, artificial pneumothorax is sometimes dangerous interference and in its effect is undoubtedly a great deal more complicated than bronchoscopy. Artificial pneumothorax has caused a number of deaths due to air embolism of the brain, while a fatal issue after bronchoscopy in the hands of an experienced specialist is exceptional.

At the Lenox Hill Hospital several patients wtih typical cases of beginning suppuration of the lung were completely healed by means of bronchoscopic aspiration alone or combined with endobronchial treatment

at the hands of the late Dr. Lynah, Dr. Jordan, Dr. Kernan and their staff. At the Lenox Hill Hospital there have also been a number of patients with subacute and chronic cases of suppuration of the lung, all due to aspiration, who were greatly relieved and in some instances cured by bronchoscopic treatment.

As is known, in one third of these early cases of abscess of the lung due to aspiration healing occurs spontaneously. But to say that, therefore, bronchoscopy is not required would of course be an unscientific statement. How can one know which of, say, thirty such patients will be the fortunate ten who will not need further treatment? Therefore, bronchoscopy at the earliest moment possible is clearly indicated in every instance of beginning suppuration of the lung due to aspiration.

The trained bronchoscopist is the best friend of these patients, for by means of suction promptly applied he lays the foundation for improvement or cure in many cases.

Today a trained bronchoscopist is an absolute necessity on the staff of every hospital. He should be a man of precision and circumspection, with a gentle touch, so as to avoid harming the patient; he should be a man whose judgment and diagnosis command respect. It will probably not be difficult before long to obtain from the present generation of physicians all the specialists of this kind needed for the larger and medium-sized cities of the country. As to the smaller cities, towns and villages, it will perhaps be a good plan to employ a skilled bronchoscopist to cover a certain district. With the present easy means of communication, he will be available on short notice in cases of emergency. Patients who are able to travel may of course go and consult the specialist of their choice.

If, in the course of weeks or months, the bronchoscopist finds that the patient is not showing improvement, it is understood that he will refer him to the surgeon. Bronchoscopy and operative surgery are typical borderline chapters.

(*b*) *By the Surgeon.*—As regards operation, one should bear in mind that each of the three subdivisions of subacute and chronic nonspecific suppuration of the lung already mentioned has its special surgical treatment.

To cure typical bronchiectasis of the honeycomb type, lobectomy usually should be the operation of choice; in this condition the radical operation will have its greatest triumphs. As a rule only one lobe, generally the lower one, is affected; in exceptional cases, the disease is bilateral.

A rival method of lobectomy is cautery-lobectomy, which appears to cause a smaller mortality than the excision of the lobe and to produce equally good end-results. At present, surgeons are making efforts to

improve the methods of dealing with the bronchial stump after lobectomy. I do not doubt that they will succeed.

If radical operation is contraindicated or not permitted, ligation of the respective branch of the pulmonary artery, with or without subsequent extrapleural thoracoplasty, may bring relief. Of three patients on whom I successfully performed this operation—successfully, at least, so far as the operation was concerned—I have seen one recover almost completely. Multiple resection of long portions of the ribs, the typical extrapleural thoracoplasty in stages, can also result in great improvement, even cure, in exceptional cases.

The advisability of operative treatment in bronchiectatic abscess of the lung which does not yield to intrabronchial treatment depends on the patient's condition and on other circumstances. If he is not in a good condition or is unwilling to undergo resection of the lung with the knife or cautery, a more conservative form of treatment, namely, the formation of a lung-lip fistula, which drains and thoroughly ventilates the existing cavity or cavities, holds out hope for a cure. Certainly not all these patients require lobectomy in order to obtain relief from their terrible distress. I have seen a number of patients, who have been dangerously ill, make a satisfactory recovery after the formation of a lung-lip fistula, also called bronchostomy, which not only drains the cavity or cavities of the lungs, but the communicating bronchus or bronchi. The fistula represents a wide canal leading into the focus of the lung and acts like a chimney. In most instances it is wide enough to admit the air required for the maintenance of life if the patient breathes through the fistula, closing his mouth and compressing his nostrils. The external opening, although it becomes lined with scar tissue all around, may close spontaneously. If it does not do so, it should be closed by operation later.

Conservative Treatment for Suppurative Foci near the Hilum of the Lung.—Suppurative foci near the hilum of the lung are often easiest and best accessible to intrabronchial aspiration and injection or irrigation. If they do not yield, conservative surgery has added another splendid procedure within the last year: persistent extrapleural compression by means of a paraffin layer the size of the palm of the hand on the exposed costal pleura, while muscle and skin are completely sutured over the same (Sauerbruch).[1] In some instances, this continuous compression alone has sufficed to heal the abscess; in others, the pus perforated to the surface between costal pleura and paraffin after a number of days, an occurrence marked by rise of temperature and local pain. Partial reopening of the sutured wound, giving easy exit to the pus and often also to the paraffin, sufficed to bring the wound to a definite close in a short time. Sauerbruch reported ten cases with ten cures.

1. Sauerbruch: Deutche Ztschr. f. Chir. **165**:353, 1926.

Of the specific chronic inflammatory suppurations of the lung, the tuberculous and the syphilitic, many of the former, even in an advanced stage, yield to extrapleural thoracoplasty and evulsion of the phrenic nerve if the artificial pneumothorax with the help of insufflation of nitrogen into the pleural sac cannot be established on account of adhesions between the visceral and the costal pleura. The cases need careful selection; from 50 to 70 per cent of the patients who would have died in the past may be greatly improved or even cured by means of these operations, if proper after-treatment is wisely and faithfully carried out.

A strict and prolonged antispecific regimen can cure the syphilitic suppuration of the lung; now and then surgical procedures must be combined with it. Surely a Wassermann test should be made in the case of every patient with pulmonary suppuration. If the test is negative but the symptoms indicate syphilis, brief antispecific treatment is indicated.

Tumors of the lung that have caused suppuration—if the tumors were not sessile on the bronchial wall and then best and clearly recognizable by the bronchoscopist—should be diagnosed as early as possible. Of the cooperating specialties, roentgenography is most helpful. Exploratory thoracotomy is usually indicated to establish the diagnosis definitely. If an infiltrating mass then becomes palpable, prompt lobectomy will in the future save many patients whose conditions otherwise, up to this time at least, would have been hopeless. Here, too, early diagnosis and early radical operation is the watchword.

It is encouraging to patients with suppuration of the lung of all types —acute, subacute and chronic, nonspecific and specific, dependent on tumors, etc.—and it is no less encouraging to physicians—that medical science has advanced so far that it is able today to bring efficient help; that the times when patients had to undergo months and years of untold suffering and misery and often ultimate death have passed; that the majority of patients thus affected, formerly practically outcasts of society on account of the intolerably foul odor of their sputum, can today be restored to useful citizenship. Truly this has been one of the wonderful achievements within the last twenty years of which every physician may well be proud.

But, let all remember that the best results with the least mortality can be obtained by team work only; that is, if bacteriologist, internist and surgeon, roentgenologist and bronchoscopist cooperate, often for weeks and months, for the welfare of the patient.

SUPPURATION OF THE LUNG

ROENTGENOLOGIC ASPECT *

WILLIS F. MANGES, M.D.

PHILADELPHIA

From the point of view of diagnosis, abscess of the lung should be an acute infectious process associated with the formation of purulent exudate and more or less destruction of lung tissue. In other words, abscess of the lung should not reach a chronic stage without a diagnosis. Early and repeated examinations by means of the roentgen rays are as justifiable as the repeated use of the thermometer and offer a great deal more benefit to the patient who has a suppurative lesion in the lungs. There is much advantage in early roentgen-ray study, not only for the purpose of diagnosis but for the purpose of localization, because a small area of density caused by an exudate is more easily localized than the larger area that develops later. The advantages of repeated examinations are that one can determine the manner of development, the rate of increase or decrease in size, and, particularly, whether the abscess has a tendency to advance toward the periphery or toward the root of the lung. By repeated studies, one has the best possible opportunity to determine the presence of a cavity that contains air which is believed to give a definite indication for certain steps in treatment.

Early roentgen-ray diagnosis is not always an easy matter when a single examination is made. One should have every bit of clinical and etiologic information possible when attempting to interpret shadows in the lungs into terms of early abscess of the lungs. As a rule in the early stage, the shadows of exudate are ill defined, and if the area involved is small and near the root of the lung, it may be entirely overlooked. If the area involved is in the central portion of the lung or near the periphery and is of considerable size, it may be mistaken for pneumonia, if it is in the apical regions, it may be considered evidence of active tuberculosis. In the early stages one sees detail in the bronchial shadows through the density of the exudate, but this gradually disappears as the exudate increases or changes in the tissues begin to develop. With a series of roentgen-ray studies, one may be able to make a fairly positive diagnosis of abscess of the lung before a cavity actually develops, especially with the aid of other data; but the diagnosis can be made by means of the roentgen-ray study alone when free air and free exudate are present in the cavity, so that one can demonstrate a fluid level.

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* Read at the Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 24, 1927.

TYPES OF ABSCESS

It is probable that the rate of destruction of lung tissue depends on the virulence of the infective organism present. Certainly this rate of destruction varies in different cases. In the less active forms, the infected area may become more or less well walled-off and may remain an area of consolidation without the formation of cavities or at least without communicating with a bronchus for a considerable length of time. The roentgen-ray diagnosis of such lesions may be a matter of considerable difficulty before the cavity is demonstrable because of the presence of air.

The opposite of this type is the case in which there is no tendency to the formation of a barrier of defense but rather a progressive extension of the lesion into more distant portions of the lobe or lobes involved. Cavities may not form, for the patient is liable to succumb to the disease early unless artificial drainage of some sort is established. Such a lesion may be called a diffuse progressive suppurative pneumonitis. If the patient lives, multiple cavities may develop simultaneously or at different intervals. In such cases, multiple operations and numerous bronchoscopies are needed to control the disease.

The so-called metastatic type of abscess is one that progresses from one part of the lung to another over a more or less extensive period, healing at one point and breaking out at another and, perhaps, distant point. In this type also, the advantages of repeated roentgen-ray examinations are apparent.

There is another more or less distinctive type[1] of abscess of the lung that is more a suppurative bronchitis and is not associated with much destruction of lung tissue, certainly not in the early stages. This abscess develops distal to certain bronchial foreign bodies. Dr. Jackson described this type clearly and showed that early cure is the rule almost without exception if the foreign body is recognized early and removed successfully. The roentgen-ray diagnosis of such a lesion really involves a diagnosis of the presence of a foreign body. When the object is metallic or of other opaque material the diagnosis is obviously easy, but the lesion may follow the aspiration of nonopaque substances, in which case one must depend on the character of the shadow, its location and, particularly, its distribution. It is always in relation with a definite bronchus or branch bronchus, and its density depends on the stage of development. In appearance and location, it is not unlike many of the so-called posttonsillectomic abscesses,[2] many of which are really

1. Jackson, Chevalier: Suppurative Diseases of the Lung Due to Inspirated Foreign Body Contrasted with Those of Other Etiology, Surg. Gynec. Obst. **42**: 305 (March) 1926.

2. Jackson, Chevalier: Post-Tonsillectomic Pulmonary Abscess, Atlantic M. J. **29**:309 (Feb.) 1926.

of the type caused by the presence of a foreign body but which, because of the infective character of the object, are much more active and destructive as a rule; because of the absence of the mechanical or obstructive properties of the usual bronchial foreign body, this type of infection is not recognized as being caused by a foreign body prior to the development of abscess, and therefore one does not have the opportunity of removing it bronchoscopically in time to prevent true abscess.

It is believed that a large percentage of the abscesses following operations or infectious diseases of the upper air passages are in the nature of infections caused by aspiration, or, in other words, the infective agent is actually aspirated or drawn into the bronchial tree during the time of the operation or during the active stage of an infectious process above. In an analysis of 202 cases, Moore [3] found that general anesthesia had been used in 159. This is considered an important point because of the bronchial irritation and temporary abolishment of the cough reflex that follows the anesthesia. The one favors infection and the other interferes with drainage. In the same study, only thirty-nine abscesses had followed local anesthesia.

The abscess that follows the route of infection caused by aspiration of the infective agent is always in relation to some fairly large bronchial branch and, as a rule, is easily accessible to bronchoscopic drainage. The abscess that follows pneumonia is usually centrally located in an area that has just recently been the site of a pneumonic process. This abscess may be near the wall of the chest or near the root area. The abscess that is found near the surface of the lung, isolated from the larger bronchial tubes and not in an ear of a recent pneumonic process, probably has been caused by infection through the lymphatic route. The abscesses that develop in the interior and are in contact with neither the pleura nor the root area probably are caused by infection through the blood stream. The last two types are in the minority.

DIAGNOSIS

It is realized that roentgen-ray evidence cannot be proof of the route of invasion, but there is such a similarity between the many proved infections caused by aspiration and the group spoken of here, which is so different from the others, that the evidence must have some value.

Next to diagnosis, localization is the most important function of the roentgenologist. It should be considered from two different points of view: first, localization with relation to a bronchus or bronchial distribution and second, with relation to the wall of the chest. The

3. Moore, W. F.: Pulmonary Abscess. An Analysis of Two Hundred and Two Cases Following Operative Work About the Upper Respiratory Passages, J. A. M. A. **78**:1279 (April 29) 1922.

former is particularily important when bronchoscopic drainage is to be employed, while the latter is essentiol when thoracotomy is to be performed.

By means of stereoscopic roentgenograms alone, one can occasionally determine the location of the abscess with relation to the bronchus or to the wall of the chest. Also, there are cases in which the bronchial distribution can be determined by the bronchoscopist when he sees exudate coming from a given bronchus. However, for accurate and complete information, pneumonography is the most dependable method.

Many years ago Dr. Jackson [4] demonstrated that the bronchial tree could be visualized roentgenographically if opaque substances were insufflated into the living bronchi. The dry bismuth subnitrate or subcarbonate was used. The bismuth salt can be made to enter the third, fourth, or fifth branch of a bronchus, but not the bronchioles or vesicular portions of the lung. After the insufflation of the bismuth, roentgenograms are made in the anterio posterior direction for stereoscopic study and also in the lateral view. This is still the best method of localizing any lesion or object with relation to a bronchus. One of the greatest advantages is that the bronchoscopist may select a particular bronchial branch to insufflate, so that even small objects, such as foreign bodies, may be localized without the interference of a great many other superimposed injected bronchi. The finely powdered bismuth can be insufflated into a lobe or even a main bronchus. It is nonirritating, does not show a tendency to accumulate or obstruct and, if it has any action, it is a beneficial one on inflamed surfaces. It also has hemostatic properties.

Centrally located abscesses that have not communicated with a bronchus are localized in this way because they do obstruct bronchi, and one sees that the bismuth stops abruptly in one or more branches while it goes farther in others.

Insufflation of dry bismuth is not adaptable for determining the size or even the presence of a cavity, and has little value in the study of the terminal branches of the bronchi.

Bismuth salts may be used in suspension in oil and when injected into the bronchi will go into the terminal bronchi, into cavities that have bronchial communication or even into the parenchymal portions of the lung.

The work of Lynah and Stewart [5] demonstrated the value of bismuth salts in oil, for both diagnostic and therapeutic purposes, in patients with

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4. Jackson, Chevalier: The Bronchial Tree. Its Study by Insufflation of Opaque Substances in the Living, Am. J. Roentgenol. **5**:454 (Oct.) 1918.

5. Lynah, H. L., and Stewart, W. H.: Roentgenographic Studies of Bronchiectasis and Lung Abscess After Direct Injection of Bismuth Mixture Through the Bronchoscope, Am. J. Roentgenol. **8**:49 (Feb.) 1921.

abscess of the lungs. Recently, iodized oil [6] has become more popular than other opaque liquids; the technic of getting this agent into the lungs varies in different localities, but in most instances gravity is depended on to carry it to the desired area. There is a definite advantage in having it injected into a particular bronchus when possible, so that a minimum of overlying shadows will be present.

The great advantage in the use of iodized oil is that it will go into the most distal portions of the lungs, or to any point where air will go.

Small quantities frequently give better results for roentgenographic purposes than large quantities. If large quantities are used, the parenchymal portion of the lung fills up and obscures everything in front or back of it, and may even be so dense in shadow as to be mistaken for a cavity. In one instance, a collection of the iodized oil remained in the parenchymal portion of the lung for many months, but, so far as could be determined, it did not do any harm.

Localization of an abscess in the lungs with relation to the bronchial tree is important, particularly if bronchoscopic treatment is to be done, but it may not suffice for surgical procedures. For the latter, one must show its relation to the wall of the chest.

Sante and Lehman [7] undertook to localize the abscess by means of a Hirtz compass, which is an instrument for accurate localization of foreign bodies with relation to the surface of the skin and which also contains a probelike indicating rod that guides the surgeon in the right direction and to the proper depth. The method is probably applicable to small, sharply defined abscesses but hardly to large, ill defined suppurating areas.

Anteroposterior or posteroanterior and lateral roentgenograms are of the first importance, and the film or plate exposures must be made with the patient in the same position that he will occupy for operation. He must be lying down, because the interior of the lung changes its relation with the wall of the chest between the upright and horizontal postures. One should also study the location of the lesion fluoroscopically in both the upright and prone postures, and mark the skin at the point where the central ray should enter for the roentenographic exposures.

When the lesion is in contact with the wall of the chest and involves the pleura, then the localization is much more simple and can be accomplished satisfactorily with the fluoroscope.

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6. Sicard, J. A., and Forestier, G.: Méthode général d'exploration radiologique par l'huile iodée, Bull. et mém. Soc. méd. d. hôp. de Paris **46**:463 (March 17) 1922.

7. Sante, L. R., and Lehman, E. P.: Localization of Lung Abscess by Roentgen Ray with Special Reference to Use of Hirtz Compass, Arch. Surg. **11**:394 (Sept.) 1925.

TREATMENT

Roentgenologists are not immediately interested in the treatment of abscess of the lungs, but probably do give the most reliable information for intelligent selection of the best method in any given case. And certainly the roentgen-ray offers the best means of observing the progress of the patient. As a rule, when an abscess is in close relation to the main bronchi or their larger branches, bronchoscopy should be adopted as the method of treatment. On the other hand, when the lesion is in contact with the wall of the chest and does not communicate with a bronchus, then surgical intervention is the method of choice. Variations from these two clearcut indications for treatment are frequent; each requires special study, as many patients have to be subjected to both bronchoscopy and operations.

Finally, one must consider the matter of differential diagnosis between acute abscess of the lungs and other pathologic processes. The history is important and frequently enables one to diagnose the condition, but bronchial new growth, possibly some tuberculous process or an infiltrating process such as syphilis metastatic growth or interlobular empyema, may present difficulties in this connection. The doubtful lesions are almost always in relation to the root area and therefore are accessible to bronchoscopy, by means of which the differential diagnosis is practically always possible. Then, too, repeated roentgen-ray examinations should be made to note the changes that take place from day to day or week to week.

SUPPURATION OF THE LUNG

LARYNGOLOGIC ASPECT *

JOSEPH H. BRYAN, M.D.

WASHINGTON, D. C.

The term suppurative inflammation of the lungs includes two conditions, one known as bronchiectasis, or suppurative bronchitis, and the other as abscess of the lungs. It is often difficult to disassociate the one from the other, and they are of such frequent occurrence that they are of interest not only to the laryngologist and the bronchoscopist but to the internist and the general surgeon. These not infrequent and distressing conditions are certainly on the increase, and laryngologists are called on to explain and to prevent their occurrence, as far as possible. The cause of many of these conditions may be found in the domain of the laryngologist.

At the meeting of the American Laryngological Association at Atlantic City in 1919, there was a symposium on streptococcus carriers, in which some of the leading physicians and bacteriologists of the country took part, and I believe that it was clearly established that the tonsils were the carriers of many forms of infection, especially the various types of streptococus organisms. We were then fresh from our experience with the soldiers in the camps and in the field in the World War. Those who were in the camps and who took part in the formation of the army may recall the havoc that was played among the troops when colds and exanthems developed which were followed by pneumonia and empyema. In the light of this experience, especially when the reports from the camps and the work done in the various laboratories were assembled, infected tonsils were found to be a source of these infections and inflammations in the lower air tract, as the infections were carried downward and produced laryngitis, bronchitis, pneumonia and empyema. The formation of the army was so rapid that all the recruits could not be thoroughly examined, and it was not until the ravages of these inflammatory conditions of the lungs became almost epidemic, resulting in many fatalities, that the cause for the outbreaks was more diligently sought. It was found that many of these recruits had infected tonsils, especially of the streptococcic variety. They were immune to their own poison, but when they were assembled in large numbers the infection was carried rapidly from one to another and infected throats and inflammations in the lower air passages resulted. These men were known as carriers. It was not until the recruits were more thoroughly examined

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* Read at the Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 24, 1927.

before being sent to their various units and all suspects isolated, cultures made from their tonsils and all foci of infection generally in the tonsils and teeth removed that they were fit for service. This was the rule at Walter Reed Hospital and it is my impression that it was followed by most of the other military hospitals as nearly as the circumstances would permit. I am not prepared to state what effect this had on the incidence of inflammations on the lower air tract, but it suffices to say that with the better care given the recruit, pneumonia and its sequelae among the soldiers were greatly reduced. The same conditions prevail today in civil life, but, of course, not to the same degree as in the crowded camps during the war. These infections are not only carried downward but upward and produce sinusitis which varies in intensity from a mild catarrhal to a suppurative inflammation of one or more of the accessory cavities. To these foci of infection may be added the teeth, when pyorrhea and abscessed teeth exist. Is it to be wondered that, with these three fields carrying infection, suppurative bronchitis and suppurative inflammations of the lungs so frequently occur?

Not all forms of suppurative inflammations of the lower air tract may be traced to the one or more types of infection already mentioned. They frequently follow influenza and produce pneumonia which may result in an abscess of the lung if it does not undergo resolution. This occurred recently in a patient under my care and who was relieved by bronchoscopy performed by Dr. Jackson. Foreign bodies entering the air tract frequently causes these suppurative inflammations also.

Tonsillectomy undoubtedly has increased the number of these distressing conditions. If this frequent complication following tonsillectomy is the fault of the laryngologists, then they should improve their technic. I believe that many of these accidents are caused by undue haste on the part of the operator, the fact that he is operating in a bloody field and that sufficient care is not exercised by the anesthetist in removing by the suction apparatus the infected blood and secretions expressed from the tonsil in the process of enucleation, and thus the infection is carried downward into the air passages by aspiration.

Not all of these accidents following tonsillectomy can be traced to direct infection. They are occasionally due to infected infarctions carried into the lungs from the seat of operation. Many operators have been surprised, after performing a clean and successful operation, to have the patient complain of a severe chill within two or three days and on examination to find a well developed pneumonia which finally results in an abscess of the lung. I do not know of any way that this accident can be prevented, except by avoiding undue traumatism.

Mixed infections also play an important rôle in the production of suppurative inflammation of the lungs. The various types of strep-

tococci, the pneumococcus and Vincent's spirochetes are frequently found in the secretions produced by these inflammations, the intensity of the inflammations depending on the virulence of the organism found. These cases require not only the individual and combined efforts of the laryngologist, the bronchoscopist and the roentgenologist, but the efforts of the internist and general surgeon to bring about a successful issue.

While not wishing to encroach on other aspects of the subject, I wish to emphasize the part the laryngologist plays, not only in making the diagnosis, but in the treatment of these patients.

THE DIAGNOSIS

Suppurative inflammation of the lungs is readily recognized, not only in the acute but the chronic types, by the foul odor of the breath and the excessive foul, purulent secretions which are frequently hemorrhagic in character.

The use of iodized oil, 40 per cent, injected into the trachea by means of a Mandelbaum syringe, has been a great aid in localizing these pathologic conditions in the bronchial tubes and lungs. This was first recommended by Professor Sicard, of the Faculty of Medicine of Paris, and was used extensively by his house surgeon, Forrestier, in 1921, in connection with roentgenodiagnostic work. It has been a great aid to the roentgenologist and enables him to bring out a perfect picture of the bronchial tree and to localize the affected parts in the roentgenogram.

Iodized oil can be injected into the trachea by direct or indirect laryngoscopy. By the indirect method about 20 cc. of iodized oil, heated to body temperature, is injected into the trachea, after the larynx is cocainized, by means of a Mandelbaum syringe. The body of the patient is tilted to the affected side, when the oil, which is heavy, seaps into the affected tubes. The direct method through the bronchoscope is more effective, and the oil is not so likely to be coughed out before the roentgen-ray exposure is made. In children, it is recommended that the oil be injected into a cannula and passed through the cricothyroid membrane, care being taken not to wound the posterior wall of the larynx. Brilliant results are being obtained by means of the bronchoscope and thereby many of these patients are saved from undergoing a radical operation.

CONCLUSIONS

1. Without a reasonable doubt, the upper air passages, that is, the oral cavities, the pharynx, with the tonsils carry many forms of bacteria, the nose with the accessory cavities and the nasopharynx may be found to be the source of many of these suppurative inflammations of the bronchial tubes and lungs.

2. Judging from the number of cases following tonsillectomy that have been reported and knowing of a number of cases that have not been reported, I believe these complications are occurring too often. When general anesthesia is employed, a good anesthetist is essential; his duty should be, by means of the suction apparatus, to keep the operative field as clear as possible from blood and infectious secretions squeezed out of the tonsil during the process of enucleation, so that they will not be aspirated into the lungs. Not all of these accidents can be attributed to the use of general anesthesia, for a number of cases have followed local anesthesia.

3. Infarction is an unknown quantity, but I believe the risk of carrying an infarction into the lungs is greatly increased by undue traumatism at the seat of the operation.

4. Bronchoscopy has shown many brilliant results in these distressing cases and should always be tried before operation is performed.

5. Air compression of the lung in acute conditions has also proved efficacious in a number of cases.

6. When the patient does not respond to the methods already described, general surgical intervention is then to be resorted to, and in skilful hands many patients have been saved.

SUPPURATION OF THE LUNG

BRONCHOSCOPIC ASPECT *

GABRIEL TUCKER, M.D.
PHILADELPHIA

The bronchoscopic phases of suppurative pulmonary disease can best be presented under two heads: (1) bronchoscopic aid to diagnosis in pulmonary suppuration, and (2) bronchoscopic aid in treatment of pulmonary suppuration.

The diseases of the lung in which the pathologic processes result in suppuration are numerous. The suppurative lesion may be primary or secondary, and is always a matter for careful differential diagnosis. The etiologic factors are many and are often obscure. Two or more conditions may coexist. In arriving at a final, positive diagnosis, one should use every available diagnostic aid. The most valuable aid in all diagnostic fields is inspection of the lesion by direct vision. In a great many of the patients with suppurative disease of the lung, this can be done by bronchoscopic examination.

Some of the conditions in which the bronchoscope has been of special aid in a positive diagnosis are:

1. Suppuration due to the presence of a foreign body.
2. Suppuration secondary to neoplasm of the lung.
3. Pulmonary abscess coexisting with acid-fast infection, as a separate lesion.
4. Purulent tracheobronchitis differentiated in many cases into spirochetosis, Vincent's infection or diphtheria by direct inspection and culture.
5. Mediastinal suppuration with bronchial fistula.
6. Bronchiectasis.
7. Pulmonary abscess (postpneumonic and postoperative).
8. Interlobar empyema.

Bronchoscopic treatment in many of these conditions has been of great value. In suppurative lesions of the lung due to the presence of a foreign body, the bronchoscopic removal of the foreign body has resulted in cure in 98 per cent of the cases.

Recently, postoperative pulmonary suppuration has received a great deal of attention from physicians, both clinically and experimentally. Since the discovery of its sequence by Dr. Charles W. Richardson, who has studied the condition extensively, posttonsillectomic pulmonary abscess has been of particular interest to the otolaryngologist. Considerable discussion has arisen as to the pathway of infection from the

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* From the Chevalier Jackson Bronchoscopic Clinics.

* Read at the Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 24, 1927.

operative field to the lung. Among those who have contributed a great deal to the knowledge of this condition and its mechanism are Moore, Fettorolf and Fox, Chevalier Jackson, Schlerter, Weidline, Cornelius G. Coakley and many others. Bronchoscopically, there is evidence that the infection occurs by both the inspiratory and the embolic routes, and from the local bronchoscopic and roentgen-ray examinations, it is often possible to tell by which route it has occurred in the individual case. Clinically, both types of abscess are amenable to bronchoscopic drainage if the patient is seen early. Experience in selected cases has led to the conclusion that the earlier bronchoscopy is done after the onset, the better

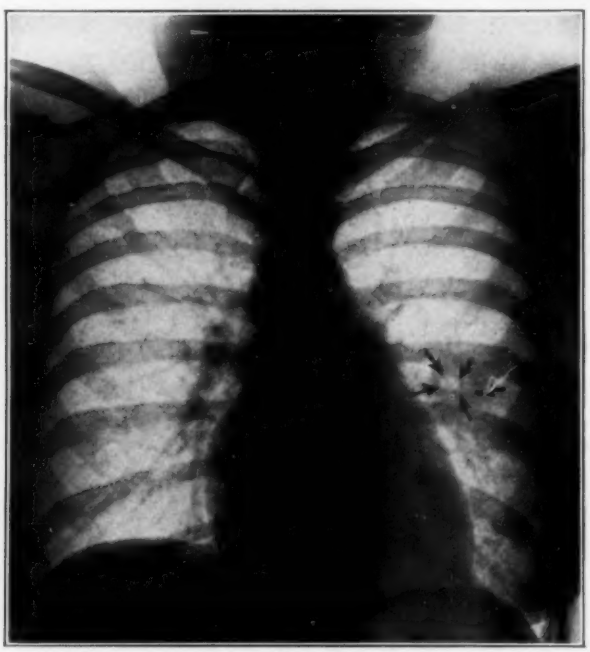

Fig. 1 (case 1).—Cavity in the apex of the lower lobe of the left lung. The secretion that was aspirated bronchoscopically showed many tubercle bacilli which confirmed the roentgen-ray diagnosis of tuberculosis. Physical examination and twenty examinations of the sputum did not show evidence of tuberculosis. Roentgenogram by Dr. Henry K. Pancoast.

it will be for the patient. Postoperative pulmonary abscess is usually manifest as an acute condition and formerly was frequently treated as postoperative pneumonia. Pulmonary suppuration may also occur as a sequel to pneumonia, particularly the influenzal pneumonia of the bronchopneumonic type. Both are amenable to bronchoscopic treatment. Bronchiectasis often follows the acute infectious diseases of childhood, such as whooping cough, diphtheria, scarlet fever and measles. In many of the patients with advanced bronchiectasis, the disease can be traced

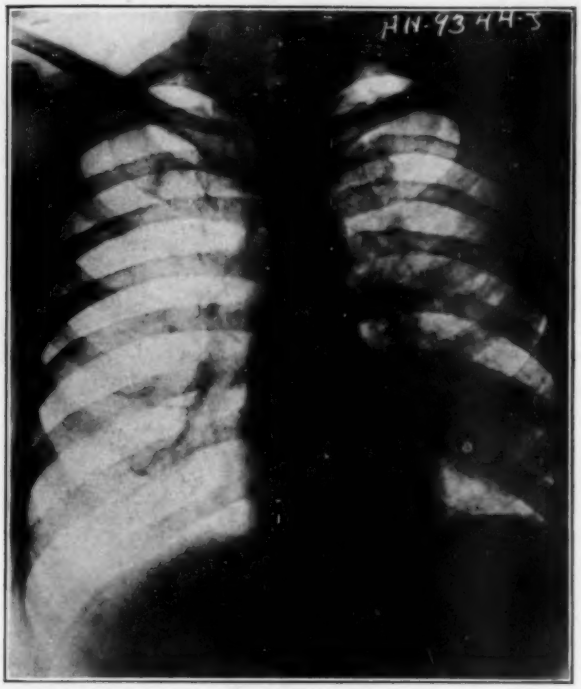

Fig. 2 (case 2).—Extent of the suppurative lesion of the left lung of a man, aged 43, before bronchoscopic aspiration.

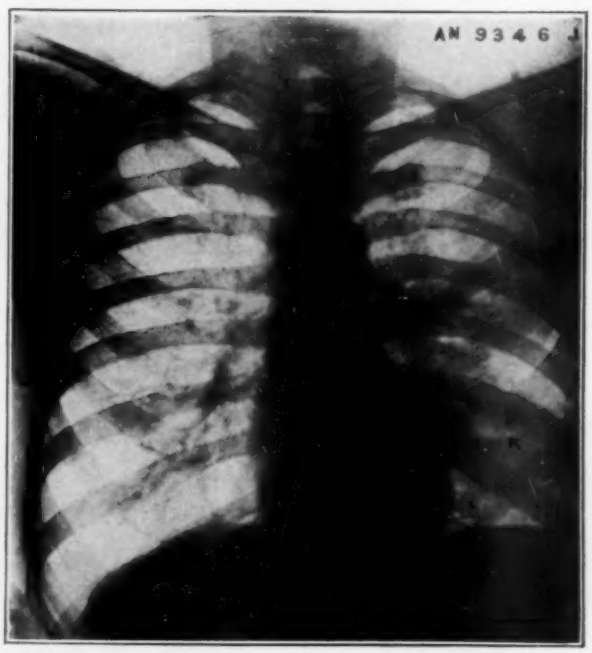

Fig. 3 (case 2).—Appearance of the cavity, which was not apparent before the aspiration, immediately following bronchoscopic aspiration.

back as a sequel to one of the infectious diseases of childhood. It is remarkable in this connection that the most gratifying results have been obtained with bronchoscopic treatment in the early cases of bronchiectasis in children in whom the condition has followed one of the acute infectious diseases.

In the diagnosis of the condition, the bronchoscopist can aid by:

1. Definite information as to the location and extent of the lesion from his direct endoscopic study.

2. Removal of secretions from the bronchi, uncontaminated by secretions from the mouth that will show the infecting organism on culture.

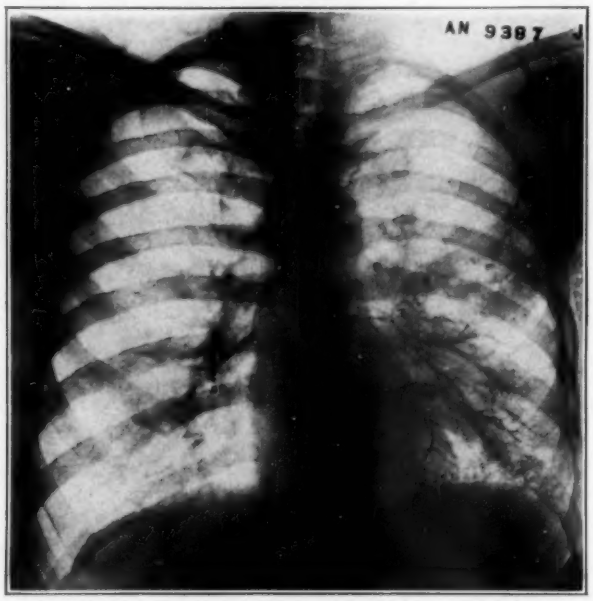

Fig. 4 (case 2).—Pneumonogram with iodized oil 40 per cent outlining the cavity.

3. Excluding the presence of a foreign body by direct examination of the larger bronchi. This examination should be supplemented by roentgen-ray study and physical examination for exclusion of foreign body in the smaller bronchi.

4. The bronchoscopic introduction of bismuth subcarbonate and iodized oil 40 per cent in cases in which the roentgenologist thinks it desirable. Obstructive secretions and granulations can be removed, and the opaque substance can be introduced into any portion of the lung that the roentgenologist desires to study. The most accurate results can be obtained by bronchoscopic introduction of the opaque substance on the fluoroscopic table.

5. Bronchoscopic removal of tissue from the lesion for histologic examination, when this is deemed advisable.

The bronchoscopist can aid in treatment by:

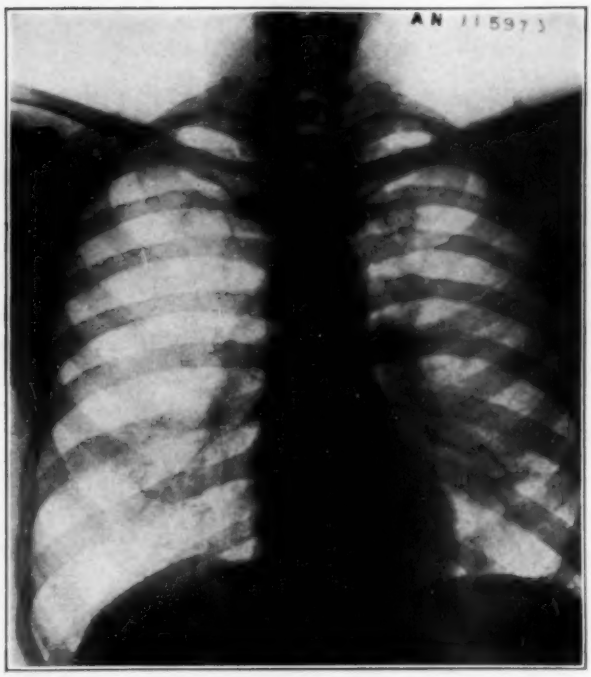

Fig. 5 (case 2).—The clearing up of the lung under bronchoscopic treatment. The patient was coughing up very little secretion and had gained 35 pounds (15.9 Kg.). Roentenogram by Dr. Willis F. Manges.

Fig. 6 (case 3).—Extent of a posttonsillectomic lesion of the right lung before bronchoscopic treatment.

1. Improving bronchial drainage through the aspiration of secretion and local treatment of the lesion.

2. Securing an uncontaminated specimen of the infecting bacteria for an autogenous vaccine.

3. Dilating strictures and removing obstructing granulations.

4. Bronchoscopic removal of a foreign body. In suppurative disease of the lung due to the presence of a foreign body, 98 per cent of the patients will be cured by the bronchoscopic removal of the foreign body. In practically all the cases, the bronchial drainage is improved to such an extent that further bronchoscopic treatment is not required.

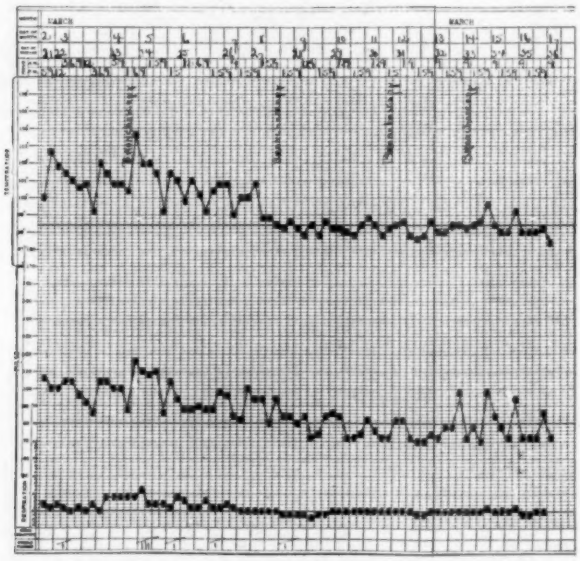

Fig. 7 (case 3).—Record of temperature showing the patient's progress under bronchoscopic treatment.

REPORT OF CASES

The following report of cases will illustrate some of the phases of the value of bronchoscopy in the diagnosis and treatment of suppurative pulmonary lesions.

CASE 1.—*Bronchoscopic aid in diagnosis.*

A woman, student nurse, aged 22, developed an acute infection of the upper respiratory tract and was kept in the infirmary of the hospital for ten days after she had recovered from the acute symptoms. Physical examination and roentgen-ray studies of her chest did not show any abnormality. When she resumed her duties, she expectorated several mouthfuls of bright blood. She was readmitted to the infirmary and kept under close observation for three weeks After her readmission to the infirmary, roentgen-ray examination revealed a small cavity with a fluid level in the apex of the lower lobe of the left lung (fig. 1). Physical examination failed to confirm this. Repeated examinations of the sputum

(twenty in all) did not reveal the presence of tubercle bacilli. Diagnostic bronchoscopy was requested by Dr. T. Grier Miller, the physician in charge. At the bronchoscopic examination under local anesthesia, thin purulent secretion was found to be coming from the posterior division of the bronchus of the lower lobe of the left lung. The secretion was collected bronchoscopically in a Clerf collector and, on examination, showed many tubercle bacilli which confirmed the roentgen-ray diagnosis of tuberculosis. The bronchoscopy was done in four and a half minutes. A reaction did not follow the examination. The patient was referred to a sanatorium, where she made excellent progress toward recovery.

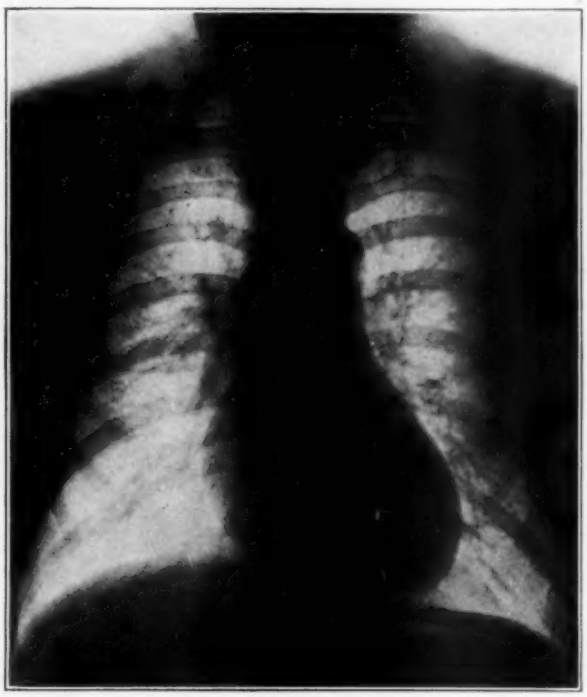

Fig. 8 (case 3).—The lung was clear following the series of bronchoscopic treatments. The man had gained 25 pounds (11.3 Kg.) and was symptomatically well. Roentgenogram by Dr. Henry K. Pancoast.

Case 2.—*Bronchoscopic aid in treatment.*

A man, aged 43, who had a mild chronic bronchiectasis, developed an acute pulmonary condition that was thought to be of influenzal origin. There was marked evidence of involvement of the lower lobe of his left lung, which extended to and involved the pleura. External drainage was considered, but the pleural involvement subsided, and the bronchoscopist was called by the surgeon, Dr. John B. Flick, and the internist, Dr. Elmer Funk, to aid in the care of the patient. The condition of the lungs improved rapidly under bronchoscopic aspiration and local medication. After the temperature had become normal, roentgen-ray examination was made just prior to a bronchoscopic treatment, in order to demonstrate the effect of bronchoscopic aspiration. A cavity was not demonstrable before

bronchoscopic aspiration (fig. 2). Immediately following bronchoscopic aspiration, another roentgen-ray examination was made (fig. 3), which showed a cavity in the involved lung. This cavity was further demonstrated by the bronchoscopic introduction of iodized oil 40 per cent (fig. 4).

Bronchoscopic treatments were continued as an adjunct to the medical care of the patient, and at the end of six weeks the man had gained 35 pounds (15.9 Kg.), and the quantity of sputum in twenty-four hours was reduced from a pint of foul pus to about 30 cc. of mucopurulent secretion. Roentgen-ray examination showed that the condition in the lung was clearing rapidly (fig. 5).

CASE 3.—*Bronchoscopic treatment as an aid to the medical care in acute postoperative pulmonary suppuration.*

A man, aged 37, was admitted to the private service of Dr. Joseph Sailer at the University of Pennsylvania Hospital, with pulmonary suppuration of three weeks' duration. The illness had begun on the third day following tonsillectomy. He was under medical care before he was referred to Dr. Sailer. He had a septic temperature which ranged as high as 103 F.; he was toxic and coughed up about 150 cc. of foul sputum in twenty-four hours. Bronchoscopic examination revealed a suppurative process in the lower and middle lobes of the right lung, which confirmed the observations of the internist and the roentgenologist (fig. 6) as to the location and extent of the lesion. After the first bronchoscopic aspiration, the symptoms subsided; the temperature gradually returned to normal (fig. 7), and the sputum decreased in amount. Bronchoscopic aspiration and local medication were carried out at about four day intervals; in all, six bronchoscopic treatments were given. The patient was discharged from the hospital at the end of four weeks, symptomatically well. At the end of three months, he had gained 25 pounds (11.3 Kg.), and roentgen-ray examination of his chest showed the lung to be clear (fig. 8).

DISCUSSION

DR. CHEVALIER JACKSON, Philadelphia: This symposium was proposed and arranged by Dr. Bryan. He thought it well to present the subject under the five phases. When a patient arrives at any of the hospitals at which we work, he may come to any one of these five departments, medical, surgical, laryngologic, roentgenologic or bronchoscopic. Regardless of the one to which he comes, his case is studied by all departments. A general examination of the nose and throat is made. The rhinologic phases to which Dr. Bryan called attention are taken up and recorded, and then he goes through the various departments; afterward we have a consultation and decide what is to be done. The surgeon watches the patient throughout his remaining under the care of any one of the departments. If the surgeon decides the time has come to operate, the operation is performed without delay, if the patient consents.

DR. MCCRAE: We do not know how many cases of posttonsillectomic abscesses occur. I did not know until ten or fifteen years after I ceased operating on the tonsil that they ever followed any of my tonsillectomies. Some of the instances of symptoms of pulmonary suppuration are recalled, but I did not see the connection between my tonsil operation and the abscess, until Dr. Charles W. Richardson pointed out this complication.

DR. C. W. RICHARDSON, Washington, D. C.: In 1910 and 1911, I became impressed with the great number of cases of so-called ether pneumonia. I followed two of these up and became convinced this was my own work; the conditions were not ether pneumonia but the direct result of my operation. I then investigated the literature on the subject and found one other case of French origin which was doubtfully described infection from the upper air

tract, but the writer of the article did not connect the two. I then wrote my observations. That was in 1911, and that paper was delivered and published in 1912.

What is the etiology of these abscesses of the upper air tract? They are seen in connection with sinus operation, and also in connection with tonsillar operations, and other types of operative intervention in the upper air tract in which pus or infected organisms are present in the tissue that is removed.

In my early studies of these cases, I as well as others who have investigated this subject, am inclined to be a little personal and believe that they are more frequently hemagenetic rather than lymphogenetic in their origin. Coming out in the open and studying them thoroughly, I think there is no question that the larger number of the cases are aspiratory in their origin. I know it has been said that they occur much more frequently in ether narcosis than otherwise. Is that an argument in favor of their origin in the blood stream? It should not be, because in the local anesthesia (now that local anesthesia is administered more frequently than formerly), there are beginning to be relatively almost as large a number of abscesses of the lungs following local anesthesia. Why? Because, as Dr. Jackson has said, the brechic reflex is destroyed by the anesthesia extending further, and the protection of the lung is lost and aspiration takes place more frequently under the local anesthesia. This is not an argument in favor of its origin in the blood stream.

In the first place, a thorough examination must be given — that is essential; the second point is the bronchoscopic treatment, and the third point is the pneumothorax.

Dr. George Fetterholf, Philadelphia: I think it was in 1911 or 1912 that I saw Dr. Richardson's report on his cases, and I must confess that I looked on it at the time as rather a medical curiosity. I did not take the matter seriously, and never thought of its coming into my own field or ken. I rather forgot it until a few years later, when I had the misfortune to lose the first case of pulmonary abscess which I am sure I had. I share the general opinion that a great many cases occur in which the patients never return.

The second point is the one Dr. Jackson brought out, that of all the foreign bodies, filthy and dirty ones, few have resulted in pulmonary abscess infection.

Thoughts began to turn rather to the embolic side than the inhalation side, acknowledging the possibility of both. However, there began to be a feeling that more emphasis should be placed on the embolic side — first through the cases reported by Moore. Moore made a collection from the reports of 600,000 tonsillectomies, disclosing 203 cases of abscess of the lung, thirty-nine of the operations having been performed under local anesthesia, and the rest under general anesthesia. The remaining 8 per cent following general anesthesia and a much smaller percentage of those cases must have been done under local anesthesia than under general.

I personally believe and would advocate that attention should be paid not so much to inhalation and protection against that, but rather to infection by way of the blood path; and that preventative efforts should be applied not only to secretion of the blood going into the lung, but toward those three factors in the formation and dislocation of septic thrombi: as little traumatism, as clean a throat and as quiet a throat, as possible. One should recognize both factors, not emphasize one or the other and try to protect against the possibility of both.

Dr. J. D. Kernan, New York: The lesson one must learn from this symposium is to spread the use of bronchoscopy all over the country. I have recently attended several meetings, one, for instance, of the American Society

of Thoracic Surgeons. No one there, except Dr. Willy Meyer and myself, spoke in favor of bronchoscopy. The surgeons could not see anything to it; hence, this society must spread the news about bronchoscopy, its use and limitations.

I firmly believe that bronchoscopy should be performed in every case, on account of the danger or the presence of a foreign body. Dr. Meyer has suggested that in every case in which iodized oil 40 per cent is used it should be introduced through the bronchoscope.

Another matter about bronchoscopy and its use in suppuration of the lung concerns the length of time bronchoscopy be continued in trying to cure an abscess of the lung. Dr. Lynah had one famous case in which he performed a bronchoscopy every week for two years and the patient was finally cured. As long as there is improvement or hope of improvement, therefore, the limit of bronchoscopy should not be set at all.

Patients with abscess of the lung following tonsillectomy are the ones who are most easily cured. I have treated twenty-seven patients by bronchoscopy. The treatment consisted of bronchoscopy every week, and in the intervals postural drainage and all the medical treatment the patient could stand. Of those twenty-seven patients fifteen recovered promptly after from one to six bronchoscopies. The abscess that responds well to bronchoscopy is near the center of the lung. This would seem to argue that the abscesses of the lung following tonsillectomy are aspiration abscesses rather than embolic abscesses which are likely to occur near the periphery.

Dr. W. M. Nesbit, Madison, Wis.: I will report some points of interest on the etiology of abscess of the lung, following tonsillectomy, performed under local anesthesia. For some time in performing bronchoscopies, I have been cocainizing the pillars of the fossi with 20 per cent cocaine, using an applicator, and continuing the procedure until anesthesia is complete. Anesthesia is considered complete when the patient attempts to swallow, and the thyroid cartilage does not, or will not, elevate. At that point, he is placed behind a fluoroscopic screen, given iodized oil in a glass and told to swallow. Again on an attempt to swallow, the iodized oil enters the bronchotracheal tree; this happens in practically every case. I have had this happen hundreds of times. It gave me the idea that possibly by local injection around the tonsil, this same mechanism was produced; hence, I injected 0.5 per cent procaine hydrochloride in the peritonsil tissue in five patients, the usual technic for local anesthesia, and following that, placed the patient behind the fluoroscopic screen, gave him iodized oil and told him to swallow it. On an attempt to swallow in all five cases, the iodized oil entered the tracheobronchial tree. This will happen every time if anesthesia is complete.

Dr. Willy Meyer, New York: I was glad to hear Dr. Kernan before the American Association for Thoracic Surgery three weeks ago, in reviewing ninety-nine of his own cases of endobronchial treatment, announce the patients not as "cured" but as "relieved" by bronchoscopy. I think that is a wise way to put it. The medical profession at large will certainly have a much better impression of the treatment, if not too much is claimed by this youngest specialty. Of course, some of these patients will be improved, others much improved and some cured by endobronchial treatment. In others, again, there will not be any benefit at all. Such patients cross the borderline into surgery.

I feel that physicians will, after this subject has been discussed again and again, refer most of the patients to a skilled bronchoscopist before other procedures are tried.

EXTERNAL OPERATION ON THE FRONTAL SINUS

A CRITICAL REVIEW *

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The external operation on the frontal sinus is not performed as often today as it was twenty years ago, and the reasons for this are obvious. In the first place, in the majority of instances intranasal measures are sufficient to drain the sinus properly and to make possible thorough irrigation of the cavity after operation. In the second place, postoperative closure of the nasofrontal opening has been of such frequent occurrence that many rhinologists have become discouraged and consequently have ceased to make any effort to use radical treatment for conditions of the frontal sinus. Some attempt external operation on the frontal sinus only in the presence of orbital or intracranial complications. Ultraconservatism of this sort is to be condemned, for when patients suffer with severe headaches there is a distinct indication for the operation after all intranasal measures have failed and it is reasonably certain that the frontal sinus is at fault. It is generally agreed that in most instances an intranasal operation which gives free drainage and ventilation of the frontal sinus will relieve the patient of severe headaches (probably in 90 per cent of the cases). It would be futile to deny the fact that many times the results of the external operation on frontal sinus are not ideal, and that after a short space of time, sometimes only six weeks, retention of secretions may occur as a result of constriction of the nasofrontal opening.

The uniformity which exists in the methods used in operating for mastoid disease does not apply to operations on the nasal accessory sinuses. It is true that the external operation on the frontal sinus gives a better insight into the pathologic process, the anatomic variations and the extent of the disease, and that it is often followed by an ideal result. It is likewise true that relief of symptoms following the operation will be more frequent if a good cosmetic result is not considered. The moment one adopts a method of operating which is cosmetically satisfactory, postoperative healing is endangered. Some authors say that their results following this operation are always ideal; the majority of those who have performed the operation, however, admit that such fortunate results have not been obtained, and that often circumstances that cannot be controlled play an important part in making the operation a complete

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failure. It is through failure that one learns, and therefore when I have again approached this difficult problem, I believe that I have used a better technic.

I have been impressed by the fact that although the external operation on the fontal sinus is not always followed by ideal results, the patient improves in health and the discharge changes in character, so that even if healing is not complete, the definite improvement warrants the employment of this operation. It is a matter of common knowledge among rhinologists who are in the habit of performing the external operation on the frontal sinus that the last word has not been spoken regarding this procedure, and that an operation should be decided on only after a careful study of each individual patient. This refers not only to the exclusion of all other factors that may be the cause of chronic headaches, but also to the exclusion of various systemic conditions that may aggravate a mild disease of the sinus and cause sufficient edema of the mucous membrane to obstruct the already narrow frontal ostium. Toxemia resulting from disease of the gallbladder, gastrointestinal derangement, diseases of the heart, kidneys and lungs and endocrine disturbances, may be sufficient cause for chronic headaches in patients who show slight pathologic changes in the walls of a sinus. A careful examination by an internist is therefore necessary before operating, especially if doubt exists as to whether the operation should be done.

The question of postoperative retention with closure of the nasofrontal opening will be discussed at length in this paper. It has been my experience and that of other rhinologists that there is a persistent tendency for the nasofrontal duct to close after the operation, with a subsequent swelling of the soft structures and a return of the distressing symptoms of disease of the frontal sinus. In other cases, it has been observed that headache returns, although external swelling in the region of the frontal sinus is not present. The various factors which probably cause this closure will be mentioned, and the method which has given the best results in establishing a patency of the nasofrontal duct after operation will be described. I have performed the operation seventy-five times. The types of operation were: the Killian, the Lothrop, the Jansen-Ritter and the modified Jansen-Ritter with mucous membrane transplants.

The indications for the external operation on the frontal sinus depend much on the personal views of the operator. I have always made it a rule never to consider a radical operation on the frontal sinus until all intranasal measures have failed; I have made an exception to this rule only when orbital or intracranial complications have been present. The operation is never urged when purulent discharge is the only complaint.

and when the general health is good. Most of my patients complained of severe headaches which had been present at frequent intervals for many years.

The first important fact to bear in mind is that chronic disease of the frontal sinus is always complicated by disease of the ethmoid sinus, and that it is impossible to decide before operation in which sinus the pathologic process is more extensive. It is not possible to decide this question by means of roentgen-ray or clinical examination; operative intervention is required, usually intranasal at first, and later from without if necessary. Cases are commonly encountered in which the roentgenogram showed marked opacity of the frontal sinus and in which the cavity was found to contain normal or slightly thickening mucous membrane at the time of the operation; the chief pathologic changes were found in the region of the ethmoid sinus. The opacity of the frontal sinus in such cases may be accounted for by the absence of air in it, the result of closure of the ostium. With the thought in mind that the key to the frontal sinus is the ethmoid sinus, efforts were naturally directed in the beginning to as complete a removal of the ethmoid labyrinth as is possible intranasally, the middle turbinate being preserved as a whole or in part if possible. I have only occasionally resorted to the more technically difficult intranasal operation on the frontal sinus according to the method of Halle, as this procedure is not necessary in the majority of instances in view of the fact that in many cases the patients are relieved by removal of the anterior ethmoid cells and dilatation of the duct with the Ritter [1] sounds. I consider the Halle intranasal method a formidable operation and never recommend it as a first requisite in operating for ethmofrontal disease, especially since simpler means often bring about the same results.

Mild pathologic changes of the mucous membrane of the frontal, especially in the region of the ostium, are sufficient cause for retention in this cavity, and readily account for severe headaches. The mucous membrane of the frontal sinus is thin and soft under normal conditions, but when it is diseased, it may become so thick that it completely fills the cavity. If only a moderate degree of hyperplasia is present, the rest of the cavity is usually filled with a tenacious mucous or purulent secretion. When the diseased frontal sinus contains many recesses and is divided by numerous septums, intranasal measures rarely are sufficient to bring about relief. The best results after intranasal measures probably occur when the frontal sinus is small, when there are slight changes in the mucosa, and when there is an absence of recesses which harbor infection. I do not agree with some surgeons who claim that a poor result following the external operation on the frontal sinus is always

1. Ritter: Deutsche med. Wchnschr., 1906.

dependent on improper technic. Postoperative retention has followed operations performed by me and my associates as well as those performed at some of the best clinics in this country and abroad and I firmly believe that exuberant granulations and scar tissue on the floor of the sinus are often the cause of this unsatisfactory result.

Little is known concerning what takes place in the cavity of the frontal sinus after the operation. It is surmised that the bony walls become lined with granulations which slowly receive their epithelial covering from the nasal mucosa and periosteum. If the granulations become exuberant in the region of the enlarged ostium, closure of this opening may occur with scar tissue and a return of the former symptoms. For this reason, faulty technic cannot be blamed in every instance for postoperative retention in the frontal sinus. It has been observed, further, that unusually good results have been obtained in cases in which only slight pathologic changes were present in the frontal sinus and in which the mucous membrane was not curetted; this condition was noted especially when complete removal of all ethmoid cells was undertaken. It is believed, therefore, that it is advisable to abstain from curetting this cavity when only slight involvement of the mucous membrane of the frontal sinus is present.

CAUSES OF POSTOPERATIVE RETENTION

The following are some of the causes of postoperative retention:

1. Failure to remove all diseased mucous membrane from the frontal sinus, in consequence of which cystic changes take place in the remaining mucous membrane; these may cause obstruction of the nasofrontal opening. It is not an easy task to remove all the mucous membrane from the various angles and recesses unless a large part of the cortex is also removed. When the sinus is curetted through an opening in the orbital wall, as I prefer, patience and the use of curets bent at various angles are required.

2. Incomplete removal of all diseased ethmoid cells, especially in the anterior portion.

3. Failure to remove the lacrimal bone and the greater part of the nasal process of the superior maxilla.

4. Removal of an insufficient amount of the crista frontalis when it forms a part of the floor.

5. Development of an osteitis, especially in the region of the crista frontalis, with the formation of excessive granulations and scar tissue.

6. The prolapse of orbital tissue into the nose because of too radical removal of the lamina papyracea.

7. Too much after-treatment which causes the formation of excessive granulations.

8. The removal of too much of the mucous membrane of the posterior wall of the ductus nasofrontalis.

Symptoms simulating postoperative retention in the frontal sinus may occur if the soft orbital tissue becomes inflamed during an acute nasal infection. Palliative treatment is usually sufficient to relieve this condition within a few days.

Ten of our patients had postoperative retention which required the opening of the sinus within from three months to two years after operation. In most instances, it was found that scar tissue had formed on the floor of the frontal sinus entirely closing the outlet of the sinus. Four of these patients were not relieved of headache. One patient developed an osteomyelitis of the frontal bone and was operated on again three weeks after external operation on the frontal sinus. He recovered and is now free from headaches. Postoperative meningitis did not occur in any of the cases. My patient who was admitted to the hospital with symptoms of meningitis had a necrotic ethmoiditis with exposed gangrenous dura, and he died twenty-four hours after operation. Other deaths did not follow the operations.

ANATOMIC VARIATIONS

There are many anatomic variations of the ethmofrontal region, and it is necessary to study the anatomy of this region carefully, in order that the variations may be recognized while the operation is being performed. One of the most frequent anatomic variations is the displacement upward of an ethmoid cell, in which case the ostium of the frontal sinus may be placed posteriorly. At other times an ethmoid cell may lie between the ostium and the orbit, or between the ostium and the crista frontalis. It may also happen that a posterior ethmoid cell is displaced upward and forward into the frontal sinus. If this occurs, the ground lamella of the middle turbinate may extend over the bulla ethmoidalis, become attached to the uncinate process and close off entirely the upper end of the hiatus semilunaris. Ritter[1] has a specimen of this kind in his collection. Whenever a displaced ethmoid cell reaches high enough to invade the squamous plate of the skull a double frontal sinus with two ostia is usually present, one draining in front of the middle turbinate and the other in the hiatus semilunaris.

A deviation of the interfrontal septum is of frequent occurrence and may be deflected to such an extent that it causes a narrowing of the nasofrontal duct. There is a more pronounced deviation of the upper part of the interfrontal septum, the lower end usually occupying a more medial position. When the deflection is in the frontal sinus which is being operated on, an ethmoid cell of the other side may be displaced and occupy a position behind the crista frontalis. When the deviation is toward the opposite side, a shelf of bone may be present on the posterior

wall near the median line running in a vertical direction, which may readily be mistaken for a small septum. This shelf of bone, called the crista olfactorius, is the anterior portion of the olfactory fossa; if removed, the dura covering may readily be torn. The crista olfactorius may be developed to such an extent that it projects forward in the form of a bulla. Onodi [2] has named this abnormality the torus olfactorius. To the medial side of the crista olfactorius may be seen a recess which is termed the recessus crista galli, and to the lateral side is often seen a deep depression which Onodi has termed the recessus paracribrosa. This recess lies on the lateral side of the cribriform plate and extends in some instances posteriorly along the greater portion of the lateral wall of the plate. It occasionally happens that a crista olfactorius is present, with the interfrontal septum occupying a midline position.

Complete secondary septums in the frontal sinus may make it appear that more than one frontal sinus is present. Furthermore, the frontal sinus may be unusually large and extend posteriorly to the sphenoid cavity along the orbital wall and laterally as far as the temporal region. Interfrontal septums may be recognized as such, as their walls are convex toward the part of the sinus already opened, the lateral walls of the frontal sinus always being concave. A laterally placed orbital ethmoid cell may be mistaken for the posterior wall of the frontal sinus. Normally, the posterior and anterior walls of the frontal sinus join at a distinct angle. This angle is not present in the region of laterally displaced ethmoid cells. Intrafrontal development of an ethmoid cell is easily recognized because of the ball-shaped appearance of the wall (bulla frontalis). These cells occupy the floor and very often cause narrowness of the ostium. A cell in the crista galli is of rare occurrence, having been found in one of a thousand skulls examined according to Kopsch.

Orbital ethmoid cells may occupy the entire superior wall of the orbit. In cases in which there is an absence of the frontal sinus, retention of pus in orbital ethmoid cells is more serious than it is in the frontal sinus, since erosion of the inner plate occurs more readily in this locality. The nasofrontal canals may drain into the nose at a point opposite the anterior end of the middle turbinate or in the region of the hiatus semilunaris. The width and depth of the nasofrontal duct is another interesting anatomic study. The duct is narrowed by the presence of enlarged subfrontal or infundibular cells, with or without intrafrontal dilatations. When the subfrontal cells are enlarged, they also displace the nasofrontal duct in various directions. It may be displaced anteriorly, posteriorly to the midline, or toward the orbit in a lateral direction. A high deviation of the bony septum may also be the means of closing the duct, and

2. Onodi: Arch. f. Laryngol. u. Rhinol., 1913.

lastly, the ethmoid cells may occupy a marked lateral position and occasionally extend posteriorly until they almost reach the optic canal. The internal angular process is made up of the spine of the frontal and nasal bone, as well as of the nasal process of the superior maxilla. The spine of the frontal sinus, called the crista frontalis, is often thick, and occupies the greater part of the floor of the frontal sinus. A dihescence of the walls of the frontal sinus may be present, first, in the interfrontal septums; second in the walls of the sputums in the cavity itself; third, on the posterior walls, and occasionally on the anterior wall.

GENERAL CONSIDERATIONS

Because at present it is customary to perform intranasal operations on the frontal sinus, an external operation is rarely attempted. I performed an external operation on the frontal sinus of a patient who had had headaches for twenty-eight years and who had been treated almost constantly during that time. He was under the care of many rhinologists in various cities, and although intranasal operations were performed, no one ever suggested an external operation on the frontal sinus, although the roentgenogram was cloudy and much pus was present constantly in the region of the nasofrontal duct. This man had a difficult time after the operation, and at present, five years later, although he still has an occasional headache, it is never severe and can readily be relieved. Such ultraconservatism is, in my opinion, not good surgical judgment. It is becoming generally believed that if the nasofrontal opening can be kept patent after operation, external operation should be performed more often. Why should patients with chronic bronchitis, with gastro-intestinal derangements from the swallowing of pus, and with severe headaches, be allowed to lose ground and become chronic invalids with myocardial changes and changes in the kidneys when an external operation may give relief, if not cure the patient? The word "cure" should never be used in relation to disease of the nasal sinus. A patient may be relieved for several years and then, as a result of a nasal infection, have another involvement of the sinus.

As a result of observations made on several patients in whom the sinus was found healthy at the time of operation and in whom the ethmoid cells, especially those situated laterally, were found badly involved, I am beginning to realize that external operation should be performed on the ethmoid sinus more frequently. These patients showed little postoperative reaction, the nasofrontal duct remained wide open, and the headache did not recur.

This brings up for consideration the frequent presence of headaches lasting from twenty-four to forty-eight hours in patients in whom the only pathologic observation made in the ethmofrontal region is that it is impossible to dilate the nasofrontal duct. In two patients, I was almost

certain that an intrafrontal displacement of an infundibular cell was the cause of the closure of the narrowing of the ostium. It was surmised that this anatomic variation was present because the Ritter sound no. 1 readily entered the nasofrontal duct but did not remain in contact at its outer end with the lowermost portion of the floor of the nose. The sound occupied a position halfway between the upper and lower walls of the nasal orifice. I rely on this observation more than I do on the taking of a roentgenogram with the sound in position, in order to ascertain by this means whether the sound enters the frontal sinus. One can never be certain that the sound has actually entered the frontal sinus when the sinus is viewed in the roentgenogram because of the possible overlapping of the ethmoid cells.

In one patient who had suffered with severe headaches several times a week for a period of fifteen years, intranasal dilatation of the nasofrontal duct did not give relief. The end of the sound could not be brought down to the floor of the nose after insertion into the nasofrontal duct. An external operation revealed an infundibular cell displaced upward, into which the sound readily passed. There was complete closure of the frontal ostium, but no pathalogic changes in either the frontal or the ethmoid cells. The patient has been free from headaches since the operation was performed three years ago. In this case, the anatomic variation was the cause of the headache. Rhinologists are constantly advocating the removal of deviated septums and other conditions causing obstruction in the lower part of the nasal cavity; they pay little attention to the various anatomic variations causing obstruction to the outlet of the sinuses above, which may often be the principal cause of severe headaches.

A unilateral headache, occurring always on the same side, is often diagnosed as migraine when nasal examination does not disclose pathologic changes. I have for a long time asked myself the question, Why is the headache always on the same side if it is caused by some systemic derangement? Why is it not occasionally on the other side? I also wonder whether there is not some anatomic variation of the floor of the frontal sinus in many of these patients, which narrows the frontal ostium so that complete closure of the ostium readily takes place as a result of a mild hyperemic state of the nasal mucosa following some systemic derangement. This thought occurred to me after I had examined many skulls and had found that the floor of the frontal sinus is often encroached on by an anatomic variation which causes a displacement and narrowing of the ostium.

In the presence of atrophic changes of the nasal mucosa, the patient must be informed that there may be a continuance of nasal symptoms after the operation. I have performed several external operations on the frontal sinus when patients have had marked atrophic rhinitis because

of the presence of severe frontal headaches and when intranasal measures have failed to give relief. These patients have been free from severe headaches, but they continue to have nasal symptoms at frequent intervals as a result of the atrophic rhinitis.

THE METHOD OF OPERATION

The patient is thoroughly alkalinized for several days, and an injection of morphine and atropine is given half an hour before the operation is performed. I have abandoned the use of tincture of iodine on the skin and use instead a solution of 7.5 per cent tannic acid in alcohol. The operation is performed under local anesthesia unless the person is extremely nervous.

The following formula of a 0.5 per cent procaine hydrochloride solution is used for infiltration anesthesia (a 2 per cent solution is, however, injected for blocking of the nerve):

	Gm. or Cc.
Procaine hydrochloride	0.5
Solution of potassium sulphate (2%).....	20.0
Solution of sodium chloride (0.9%) q.s.ad.....	100.0

The injection is made along the supra-orbital ridge, the nasal bone and the frontal process of the maxilla to a point opposite the lower orbital ridge. A small portion of the skin overlying the frontal bone is also infiltrated, the anterior ethmoid nerve is injected by inserting the needle along the upper orbital wall, half way between the supra-orbital notch and the inner canthus of the eye to the extent of about 4 cc. (fig. 1). This injection should be made only if an external operation is being performed; if the anterior ethmoid nerve is blocked before the intranasal operation, there is danger of the forming of a hematoma and the causing of pressure over the optic nerve. The nasal mucosa is well anesthetized, and the lateral wall of the nose opposite the middle turbinate is injected with the procaine hydrochloride solution. The second branch of the fifth nerve is blocked by injecting 2 per cent procaine hydrochloride solution into the posterior palatine canal. A cotton tampon containing 10 per cent cocaine is then placed on the floor of the ethmoid sinus and another is placed high up between the middle turbinate and the septum. The eyebrow is not shaved.

The incision in the skin begins a little to the medial side of the supraorbital notch and extends downward to a point opposite the lower orbital ridge (fig. 2). The incision is not made in the eyebrow, but immediately below it, and is carried well up on the nasal bone so that the scar will have a bony support. After all bleeding is stopped, the periosteum is divided and the soft orbital tissue carefully dissected; for this purpose, either a small periosteal elevator or a flat chisel is used. In several cases in which severe headache was present and in which I surmised that there was also an anterior ethmoid neuralgia, the orbital tissue was elevated until a good view of the anterior ethmoid nerve was obtained. This nerve was then steadied with a hook and divided with scissors. A prolapse of a small part of the orbital fat after division of the nerve usually occurs and occasionally profuse bleeding.

The opening in the frontal sinus is made on the orbital floor by placing the chisel on the lateral side of the nasal process of the superior maxillary bone. The direction of the chisel is from above downward and toward the eye. After an opening of sufficient size is made in the frontal sinus, the cavity is packed with

gauze saturated with a 10 per cent cocaine-epinephrine solution. The nasal process of the superior maxillary bone, as well as a part of the nasal bone, and also the lacrimal bone are removed with the Hajek maxillary punch forceps; it is advisable to abstain from the use of the chisel because of the discomfort to the patient. Care must be taken to remove only a little of the lamina papyracea for this wall is important in preventing postoperative prolapse of soft tissues into the nose. The opening in the bone should be wider below than it is above (fig. 3).

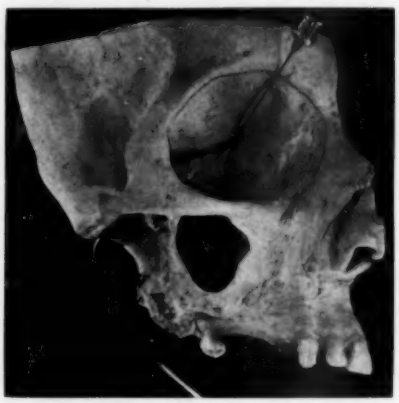

Fig. 1.—The needle is injected into the anterior ethmoid nerve along the upper orbital wall.

Fig. 2.—The line of incision beginning a little below the eyebrow and extending into the nasal bone.

If the frontal sinus extends laterally, it is better to enlarge the opening on the floor of the orbit so that all recesses of the frontal sinus may be explored.

The ethmoid cells are next carefully removed with a biting forceps and a curet, applied in a downward direction; the nasal mucous membrane is preserved, if possible. This membrane is of importance if one wishes to use mucous membrane flaps. As the floor of the frontal sinus is made up of the crista frontalis (a part of the internal angular process of the frontal bone) and the turbinate

wall of the ethmoid, it becomes necessary to secure a wide opening in this region in order to remove as much of the crista frontalis as is possible. In removing the crista, however, one must be careful to chisel forward and laterally, not toward the midline, for fear of opening the cribriform plate. Another dangerous place to chisel is at the point where the interfrontal septum touches the posterior plate of the frontal bone; here the cribriform plate begins. After the ethmoid labyrinth has been thoroughly removed, after all small ethmoid cells lying posteriorly have had the necessary attention and after the sphenoid cavity has been explored, attention is again directed to the frontal sinus cavity. The interfrontal septum is examined, and if it is deviated to the opposite side, a careful examination of this region is made for the presence of a crista olfactorius, recessus crista galli and recessus paracribrosa. If present, little if any curetting must be done in this area as the dura may be injured. Every vestige of diseased mucous membrane is removed from the remaining sinus cavity, curets bent at various angles being used

Fig. 3.—Extent of removal of bone.

for this purpose. A better view of the cavity of the frontal sinus is obtained when the ledge of bone projecting inward from the posterior surface of the supra-orbital ridge is removed with a flat chisel. At this stage of the operation, the roentgenogram should be viewed in order to determine the presence of intrafrontal septums which must be broken down. It is advisable not to perform curettage on the sinus cavity if the mucous membrane is only slightly thickened.

I always attempt to preserve the middle turbinate, although marked hyperplasia may occasionally require removal of a part or the whole. The preservation of the middle turbinate leaves a normally functioning nose and is a reliable guide during the operation, so that by following the lateral wall one is able to prevent injury of the cribriform plate. After the removal of the middle turbinate, there may be an infection along the sheath of the cut or torn olfactory nerves which communicate with the arachnoid space, and this infection may be the cause of meningitis. The preservation of the turbinate also prevents the formation of a crust after operation. If the nasal mucous membrane has remained intact, the

next procedure is to make the flap according to the method of Uffenorde.[3] The membrane is divided by making an incision transversely from above downward, so that a large part of the flap occupies the lowermost portion of the opening and the small upper part is placed upward into the frontal sinus (fig. 4). This upward nasal mucous membrane flap covers the region of the crista frontalis, where postoperative osteitis usually develops and produces excessive granulations

Fig. 4.—Line of incision in the nasal mucous membrane. The large part of the flap is seen in the lower opening and the small upper part in the frontal sinus.

Fig. 5.—Removal of the mucous membrane from the lip for transplantation in frontal sinus operation.

with secondary constriction of the duct. The flap from the nasal mucosa prevents the forming of granulations at two important places where, by their presence, there may be a subsequent closure of the outlet. I believe that the Uffenorde[3] flap is probably much better than the one which covers only the lowermost part of the duct. A well placed flap above in the region of the thick bone of the

3. Uffenorde: Ztschr. f. Hals-, Nasen-u. Ohrenkrankh., 1923.

crista frontalis will undoubtedly be the means of preventing a subsequent osteitis and the formation of excessive granulations.

Laval[4] first suggested the mucous membrane transplants from the lip. I have used this method in some cases in conjunction with the nasal mucous membrane flaps, and I believe that if this is done, there is less likelihood of closure of the nasofrontal opening after operation. The mucous membrane transplants are taken from the lower lip, after cocainization, with a small razor or with a safety razor blade held by a hemostat (fig. 5). The mucous membrane transplants are then placed on that part of the remaining bony edge of the wound which is not covered by the mucous membrane flaps (fig. 6). After this is done, the wound is closed with silk sutures; packing is not used in the frontal sinus. The outer dressing is removed at the end of twenty-four hours; an attempt is then made to cover the wound only during the first week, when a protective dressing is applied at night.

Fig. 6.—Operation completed, with the mucous membrane flaps and transplants in position.

POSTOPERATIVE TREATMENT

With the exception of applying cocaine-epinephrine tampons in the middle meatus, little after-treatment is given during the first two weeks. If there is much discharge of mucus or pus at this time, the cavity is irrigated with a hypertonic salt solution. If granulations develop, they are treated with a 5 to 10 per cent solution of silver nitrate.

SUMMARY

I have not attempted to discuss at length the many factors pertaining to chronic disease of the frontal sinus; the surface of this difficult problem has merely been scratched. I have based my paper on observations that I have made during the past fifteen years. I have had some failures; in some patients, the symptoms have recurred and further

4. Laval: Ztschr. f. Hals-, Nasen-u. Ohrenkrankh., 1925.

operative intervention has been required before a good result has been obtained; in other cases, the result has been ideal. I have attempted to show the cause of my failures, and I have purposely emphasized this part of the subject in order that the subsequent discussion will impart more knowledge and greater insight into the difficulties attending operations on the external frontal sinus.

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ABSTRACT OF DISCUSSION

Dr. Joseph D. Heitger, Louisville: On the basis of the anatomic variations of the frontal sinus, cases of suppurative disease of the cavity of the sinus are classified into cases requiring ventilation and drainage and those requiring obliteration. Dead spaces demand an opening into the nose, if recurrences are to be avoided. The essayist has well said that postoperative healing is endangered by cosmetic consideration. When disease of the frontal sinus has advanced to a degree demanding removal of the diseased mucous membrane, only an obliterating and deforming operation, such as the Reidel or permanent patency of the nasofrontal duct can guarantee freedom from recurrence. A cosmetically controlled operation is too often merely an extended drainage operation which provides neither ventilation, nor drainage nor obliteration. Patients with orbital and cerebral complications of an acute nature are, no doubt, best treated surgically as the general surgeon deals with a suppurative ruptured appendix, namely, by the establishment of adequate drainage with as little trauma as possible, leaving the chronically diseased mucous membrane and bone to be dealt with at a later date. When intranasal measures fail, as they do in about 10 per cent of the cases, external operation must be performed. Unless an obliterating operation is done, one runs the risk of recurrence, even after many years, because of closure of the nasofrontal duct followed by retention. The causes of this closure have been so well described by the essayist that further comment is superfluous.

Of the various intranasal methods, the Halle nasofrontal operation is the most radical. It establishes better drainage because it permits of all the drainage that is anatomically possible, and the mucous membrane flap tends to prevent closure of the nasofrontal duct. Frontal involvement is no longer spoken of alone, but rather ethmofrontal disease. Frequently there is also involvement of the maxillary antrum of such a degree that radical operation on this cavity becomes necessary. This operation should be done from ten days to two weeks before the external frontal operation. Neglect of this procedure has, no doubt, been responsible for some failures of the operation of the external frontal sinus. Hirsch's work has shown that in many cases of recurring polypi, the maxillary antrum shows polypoid degeneration of the lining of its mucous membrane even when puncture and washing give a negative result.

Dr. Sam E. Roberts, Kansas City, Mo.: Where there is wide difference of opinion as to the proper method of procedure in any medical or surgical condition, there is usually something wrong with all procedures. Dr. Mithoefer's keynote statement "patency of the frontonasal duct is necessary to obtain good results" should focus our discussion on the best method to obtain that patency. Four or five years ago, I advised the use of a through and through 18 to 20 F catheter to be retained in wounds from three to six weeks. The upper end of the catheter is stitched into the external wound and the lower end extends into the nose 1 or 2 inches. By leaving the tube in position for six weeks, a firm ring of scar tissue is formed along the frontonasal duct, which does not close. I advise this

procedure after performing the Lothrope operation, although it may be used following any external operation. All internasal operations on the frontal sinus have been signal failures in my hands. By internasal operation, I do not mean refracture or the partial amputation of the middle turbinate, which should always be done before a radical measure is introduced. I refer specifically to the various rasping or burr operations in which the sinus is actually penetrated. I cannot agree that all ethmoid cells should be removed; only those cells which are definitely interfering with drainage should be sacrificed. After ten years' experience with this method, and obtaining almost universally good results, I can see no reason for adopting any other procedure which mutilates the nose inside and at times leaves hideous external deformities.

Dr. J. A. Pratt, Minneapolis: In treating the intranasal frontal sinus, a few things are essential. There must be space in which to work, and this necessitates a straight septum, otherwise the operation will have to be performed on a deviated or thick septum. All anterior ethmoid cells must be exenterated when the frontal sinus is penetrated, and it is just as well to eradicate both anterior and posterior ethmoid cells, because they are vestigial in the opinion of many. These cells are there seemingly to block the drainage of the frontal sinus. With the middle turbinate over, because the middle turbinate will break toward the septum when these partition cells are broken down, plenty of space is allowed. In the ethmoid sinuses that I open, I find that the 45 angle curet will drop into the opening of the frontal sinus in about 50 per cent of the cases, because the majority of the floors of the frontal sinus are made by the anterior ethmoid cells. If one opens the ethmoid sinuses in this manner and does not obliterate the frontal duct (which is one of the great faults of external operation on the frontal sinus), and this portion of the duct is relined with mucous membrane, there will be an opening large enough to put in at least a no. 6 Ritter sound, and I do not consider the treatment complete unless, when my patients come back the frontal duct will admit this instrument.

In enlarging the frontal sinus, I use a Good-Thompson anterior rasp, and in that way I do not disturb the posterior portion of the canal. When the middle turbinate is left in place, it is a landmark for passing a probe up into the frontal sinus, and it is always there. If the middle turbinate is removed anteriorly, which is never necessary, this landmark is lost. The majority of operators, unless they are successful and have done a great deal of this work, are unable to find the frontal sinus again.

Dr. Lee M. Hurd, New York: I have reduced external sinus operations about 75 per cent. I still believe that the Kilian operation is the best external operation, but it is the most difficult one to perform because every bit of mucous membrane must be removed out of every spot. Lately, I have tried an easier operation, that is, the Lothrope. I take out the middle turbinate, peel it and put it in as an implant all around the frontal orifice, to determine whether I can establish a large opening into the frontal sinus for drainage. The great difficulty is, as Dr. Mithoefer brought out, that the frontal sinus closes. The intranasal operation is the successful one I suppose in more than 95 per cent of the cases. The anterior ethmoid cells on the floor of the frontal sinus are well removed, but not roughly removed—I do not use the curet and rasp all around, but try to leave some mucous membrane which will give a good opening. In some of those cases it is hopeless to think of trying to perform an intranasal operation because drainage cannot be established on account of the septums that project backward or up from the crista galli, leaving pockets that have to be removed.

Dr. Austin E. Hayden, Chicago: Dr. Mithoefer said that the septums are always convex and that the lateral wall of the sinus is always concave. I had one case in which this was not true, and had that rule been followed, serious consequences might have occurred. Frequently, if not always, the septums can be located by the roentgenogram, and at least the measurements taken from it as compared with the actual measurements made at the operation are a safer guide. That is to say, if the wall seems to be half an inch from the center line, and the roentgenogram shows that the lateral wall of the sinus extends three-quarters of an inch beyond the half inch, it is safe to conclude that that is a septum, whether it is convex or concave. Otherwise, I think that danger can easily be encountered if one adheres to the rule that all septums are convex and the walls are concave.

In discussing operations of the frontal sinus, antrum operations or ethmoid operations, a great deal is said about the middle turbinate. Nothing is said or very little attention is paid to the inferior turbinate. I wish to submit this fact: in all operations on the sinus not only is drainage to be desired but also ventilation. If an enlarged inferior turbinate tip, posterior tip, obstructs the posterior opening from the nose or if an enlarged septum or a spur lower down and far back obstructs it, this may be a constant source of failure following any operation. In the conservatism that has been the watchword in intranasal surgery for the last few years, it seems that the pendulum may have swung just a little bit too far in regard to the posterior tip of the inferior turbinate. I have seen a number of cases in which the condition has cleared up after attention was given to this particular phase of the operation that I think would not have resulted successfully if it had been overlooked.

Dr. S. A. Schuster, El Paso, Texas: I should like to ask Dr. Mithoefer how he applies the mucous membrane transplants in his operation.

Dr. Oscar Wilkinson, Washington, D. C.: I want to endorse fully the use of local anesthesia in the performing of the radical operation on the frontal sinus. Local anesthesia converts this operation from one of the most troublesome and difficult operations to a relatively easy one. There is no question but that anesthesia can be effective in this work. I have been using local anesthesia for three or four years, and now give a general anesthetic only when the patient demands it. I believe the ease with which one can work, and the completeness of the work is not comparable with that secured under the use of ether. I always give morphine and scopolamine thirty minutes before the patient is brought into the operating room; frequently while I am operating the patient even snores. With reference to the preservation of the middle turbinate, I think Dr. Pratt's idea is good, but as Dr. Hayden has said, whenever ventilation is interfered with, we should not let the sacrifice of the middle turbinate body keep us from getting ventilation. Aeration and ventilation is the secret of success in all work on the sinus. When the middle turbinate body is bulbous, it certainly must be removed.

With reference to drainage, I am in entire accord with Dr. Roberts. If it is desirable to keep the opening patulous, it must be done by keeping a tube which should be used long enough for granulations to form about the tube and give a patulous opening. I think his idea of keeping the tube in place for six weeks is good.

I am sure the secret of the success of Dr. Lynch's operation, which he described several years ago, was due to using the very large tubes that he placed in the nasal cavity for drainage for one week. I think that as long as there is a discharge through the drainage tube, it should remain. As a rule, if a clean operation has been performed and the interior of the cavity has been painted with

compound solution of iodine, there will be a dry cavity within two or three weeks; after that time, the drainage tube may be taken out. The amount of discharge determines the time when I remove the tube. The larger the tube and the longer it is left in place, the surer one is that there will be a patulous opening.

Dr. M. M. Cullom, Nashville, Tenn.: I had the pleasure of seeing Dr. Lynch perform his operation in 1921, and since then I have been following his technic as closely as I can. My results have been exceedingly satisfactory. A disease of the frontal sinus that calls for an external operation is a serious problem. It is my belief that one should operate on the antrum first, clean out the ethmoids under local anesthesia, carry out all the preliminary measures on the ethmoid, sphenoid and the antrum, and then perform the external operation. I have performed ten of these operations according to Lynch's method. The results have been satisfactory. The operation is absolutely clean, and there has not been any crusting or pus. The secret of this operation is to remove all the diseased mucous membrane, the floor of the sinus and the papyracea completely down into the nose. These ten patients have been operated on over a period of six years, and I have them come to see me at intervals so that I may know how they are getting along. Not one has any pus in the nose now, and as far as one can tell, these noses are normal.

Dr. William Mithoefer, Cincinnati: The object of the paper was to discuss the external operation on the frontal sinus and not to talk about the internal operation. I was asked a question regarding transplants. The answer to this will be found in the paper. Regarding drainage tubes, I have used them and kept them in for three or four weeks, sometimes longer; nevertheless, many patients had a constriction of the nasofrontal duct at the end of from three to six months. A constriction may occur later when an infection takes place in the frontal sinus. Regarding the Kilian operation, I do not believe that that operation should be performed often; first, because of the great deformity caused in many cases; secondly, because little recesses form in different parts of the frontal sinus and give rise to recurrent infection; and, thirdly, because osteomyelitis or meningitis may occur as the result of a thrombophlebitic process in the veins. If the operation is confined to the orbit in which there is no thick deploic bone, this complication will not occur often. I should like to see the skull that Dr. Hayden mentioned in which the temporal wall of the frontal sinus was convex. I have never seen one. All those that I have examined have been concave.

With regard to the operation, Dr. Cullom spoke about performing a Lynch operation. I did not mention it as a Lynch operation in my paper, because Jansen and Ritter described it in 1904, and I thought that in the literature it was called the Jansen-Ritter operation. If Lynch's operation is different than the one described by Jansen-Ritter in 1904 and in 1906, I will have to give him the credit for this in my paper, but I do not know that there is any difference between the two. They are both done by the orbital route. The message I wanted to bring is that all operators do not have good results; all have difficulties. But do not let this discourage you, because when a good result is achieved, the patient is extremely grateful.

MUCOCELE OF THE ACCESSORY NASAL SINUSES*

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Mucocele of the accessory nasal sinuses has been regarded with interest for many years. Though it has long been considered a rarity, the gradually increasing number of reports in the literature demonstrates that it is more common than is generally supposed. It seems important, therefore, that its nature and clinical manifestations should be thoroughly understood if mistakes in diagnosis and treatment are to be avoided.

By the term mucocele is understood the accumulation and retention within a sinus of a mucoid secretion owing to continuous or periodic closure of its ostium and resulting in gradual thinning, distention or actual erosion of one or more of its walls. The frontal and anterior ethmoid celis are most commonly affected. Mucocele of the sphenoidal sinus is extremely rare; in fact its occurrence is disputed by many. Cases, however, have been reported by such careful observers as Hajek [1] and Gerber. While mucocele of the maxillary sinus is theoretically possible, it seems beyond question that the majority of cases so reported have really been cysts of dental origin which in their growth have obliterated the antrum.

ETIOLOGY

The onset of these cases is usually so gradual and the course so slow and painless that the etiology is always difficult to establish with any certainty. Turner [2] believed that as the result of a preexisting catarrh, low grade, chronic inflammatory changes take place within the affected sinus which cause temporary or permanent occlusion of its ostium with consequent accumulation of the mucous contents of the cavity. On the other hand, Killian, Howarth [3] and others have reported numerous cases in which trauma appears to have been the direct exciting cause. Then, too, an interesting group of cases has been described by Luc, Howarth,[4]

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1. Hajek, M.: Nebenholen der Nase, Leipzig and Vienna, F. Deuticke, 1926.

2. Turner, A. L.: Mucocele of the Accessory Nasal Sinuses, Edinburgh M. J. **64**:396 and 481, 1907; A Contribution to the Pathology of Bone Cysts in the Accessory Sinuses of the Nose, ibid. **56**:299, 1902.

3. Howarth, W. G.: Mucocele and Pyocele of the Nasal Accessory Sinuses, Lancet **201**:744, 1921.

4. Howarth, W. G.: Mucocele of the Frontal Sinus Caused by a Large Osteoma, J. Laryng. & Otol. **39**:265, 1924.

Bacher [5] and Axenfeld in which mucocele has developed following occlusion of the ostium by an osteoma. It is evident that while the etiology may be varied, more or less complete blockage of the ostium of the sinus is essential.

CLINICAL FEATURES

The age at which mucocele may develop varies widely. As a result of his investigation, Turner emphasized the frequency of this condition in youth and early adult life. In Howarth's series, however, most of the patients were over 60, the oldest being 85. It is evident from a study of the literature that the age of the patient is too variable a factor to be of any value in diagnosis. The condition seems to occur in both sexes with equal frequency.

As a rule swelling in the orbital region is the first thing to disturb the patient, and consequently the ophthalmologist is frequently the first to see him. The examiner is at once impressed by the slowly progressive character of the swelling as well as by the almost complete absence of pain and local tenderness. It is often observed that the swelling has remained stationary for several years before evident increase in its size is noted. Headache of any intensity is surprisingly uncommon. The swelling characteristically occurs at the upper inner angle of the orbit at the point where the walls of the frontal sinus or ethmoidal labyrinth are thinnest. As a result, the eyeball is usually displaced downward and outward. Occasionally exophthalmos is observed, especially in cases in which the affected sinus protrudes deeply into the orbital roof. The palpebral fissure may be strikingly lowered. Diplopia may occur but is often absent even in cases of marked orbital displacement. The movements of the eyeball are not usually affected, and the fundus is usually unchanged. Epiphora may be an early and often misleading symptom, particularly in ethmoidal mucocele suggesting derangement of the lacrimal apparatus. Less frequently the swelling may involve the anterior wall of the frontal sinus, especially in mucoceles of traumatic origin. In ethmoidal mucoceles, nasal obstruction or actual deformity may be present.

On palpation, one is impressed by the absence of local tenderness. The overlying skin appears normal and is freely movable. The swelling may be hard as bone or may yield a parchment-like crepitation. If actual erosion of the wall of the sinus has taken place, a fluctuating, doughy tumor may be felt protruding through the bony defect, the edges of which often feel considerably thickened as the result of local periostitis. The size of the swelling is not reduced by pressure. Intranasal examination is usually normal in mucoceles of the frontal sinus, although in

5. Bacher, J. A.: Mucocele of the Frontal Sinus Caused by an Osteoma, California & West. Med. **23**:1444, 1925.

ethmoidal and sphenoidal cases, intranasal displacement of the wall of the sinus will often be noted. The absence of nasal secretions is characteristic, although a history of intermittent mucoid discharge may occasionally be obtained.

DIFFERENTIAL DIAGNOSIS

In straightforward cases of mucocele with classic symptoms and signs, the diagnosis does not usually present difficulties. Nevertheless, tumors of the frontal sinus and orbit, especially osteoma and fibrosarcoma, may prove confusing. There are numerous cases on record in which at operation suspected mucoceles have proved to be malignant tumors. In osteoma, the roentgen ray will prove of great diagnostic value, revealing a characteristically dense shadow. Cystic dilatation of the lacrimal sac may resemble an ethmoidal mucocele, but in these cases compression of the tumor will usually force fluid into the inner canthus or inferior meatus. Sebaceous cysts, meningoceles and dermoids have also been described in this area and may closely simulate a mucocele. Acute infection of the contents of a mucocele (pyocele) may occur, greatly altering the clinical picture. It is important to bear in mind that the not infrequent extension of ethmoidal cells outward and backward into the orbital roof makes it impossible to rely with any certainty on the location of the swelling for exact information concerning the sinus involved.

PATHOLOGIC CONSIDERATIONS

The frontal and ethmoidal sinuses are lined by a thin, delicate mucous membrane covered by a layer of ciliated epithelium. Curiously enough, as the studies of Zuckerkandl and Onodi have shown, mucous glands are found only at intervals. In the patients with mucocele examined by Onodi and other observers, changes of a low grade chronic inflammatory nature were present both in the lining mucous membrane and in the underlying bone, the latter undergoing absorption and erosion. It is of interest, however, to note that the lining mucous membrane is usually thin as compared with the thickened, often polypoid mucous membrane observed in cases of chronic suppuration. Turner has made the important observation that new bone may be laid down close to the areas of erosion so as to give the impression of formation of osteoma. Although it is usually the inner third of the floor of the frontal sinus—its weakest point anatomically—that gives way, erosion of the posterior wall with exposure of wide areas of dura is not infrequent. Erosion of the anterior wall is less common and is usually seen in cases of traumatic origin. In ethmoidal mucocele, erosion of the lamina papyracea is frequently observed.

Of extreme interest from the standpoint of etiology is the condition of the nasofrontal duct. In Turner's series, it is recorded as being

closed in four cases and open in three cases. It is evident from a review of the literature that the duct is not completely closed in all cases. Nevertheless nasal drainage is seldom noted, evidently because the secretions are usually too thick and viscid to escape.

The contents of the mucocele varies greatly in both color and consistency. Usually it is a green or brownish, thick, tenacious, almost gelatinous fluid, but it may be clear and serous in character, as in one of Turner's cases. Cultures are usually sterile. Microscopic examination shows little except mucus, degenerated epithelial cells and occasionally cholesterin crystals.

TREATMENT

Treatment should be directed toward establishing a large permanent communication with the nose. Attempts to obliterate the cavity or to preserve it without establishing adequate intranasal drainage have repeatedly proved unsuccessful. While in certain cases, especially when the mucocele is confined to the ethmoidal labyrinth, simple intranasal opening will suffice, nevertheless in the majority of cases of well developed mucocele an external operation will be necessary. By way of the usual incision in the eyebrow, the floor of the frontal sinus is exposed and removed and a large communication with the nasal cavity effected by destroying the anterior ethmoidal cells. The lining mucous membrane is not disturbed. A large drainage tube is then passed from the sinus into the nose and left in position for several days. The external wound is closed. Prompt subsidence of orbital symptoms usually follows operation.

REPORT OF CASES

The following interesting cases of mucocele have recently come under my observation:

CASE 1.—*Mucocele of the right frontal sinus.*

R. T., a man, aged 29, was admitted to the eye clinic of the Strong Memorial Hospital complaining of a swelling below the right eyebrow and displacement of the eyeball. He had first noticed the swelling about seven years before. There was no previous history of symptoms referable to the right frontal sinus or to trauma. The course had been symptomless except for the gradually increasing orbital displacement; nasal discharge had not been noticed. Five years before, the swelling had been incised and drained with prompt relief, but several months later recurrence took place.

Examination showed a marked swelling in the upper inner angle of the right orbit, displacing the eyeball downward, outward and slightly forward. The right palpebral fissure was about 1.5 cm. lower than the left, and the floor of the orbit was definitely lowered. Movements of the eye were normal except for limitation on looking upward and inward. There was no diplopia. The skin over the tumor was normal. On palpation a large defect in the orbital roof could be distinguished and protruding through it was a large, doughy, fluctuating mass. Tenderness was not present. Intranasal examination was normal, and

Fig. 1 (case 1).—Mucocele of the right frontal sinus. The orbital displacement and lowering of the palpebral fissure are apparent.

Fig. 2 (case 1).—The arrow indicates the wide area of destruction in the floor of the right frontal sinus, secondary to the expanding mucocele. Fluid employed in irrigating the right antrum returned clear.

secretion could not be seen in the nose after firm pressure on the swelling. The right frontal sinus was dark on transillumination and was shaded in the roentgenogram. The eyegrounds were normal; vision was 20/25.

Under intratracheal anesthesia, an incision was made along the line of the eyebrow. As the soft tissues were retracted, a large amount of brownish and extremely thick tenacious fluid welled out. This proved too gelatinous to remove with suction. The frontal sinus was of great size extending far backward into the orbital roof as well as upward into the frontal bone. A large portion of its floor had been destroyed, but no other areas of erosion were noted. The lining mucous membrane was thin and delicate and was not disturbed. A communication with the nose could not be demonstrated. The remainder of the floor of the sinus was removed with rongeurs and a large opening made into the nose by destroying the anterior ethmoid cells. (The anterior half of the middle turbinate had previously been removed.) A large rubber tube was drawn down into the nose and the external wound closed. The patient made an uneventful recovery, although slight lowering of the palpebral fissure persisted. The nasal tube was kept in position (it was frequently removed and cleaned) for four weeks after operation. Cultures from the secretion were sterile.

Case 2.—*Mucocele of the left frontal sinus.*

A man, aged 21, came to the clinic complaining of gradually increasing swelling at the upper inner angle of the left orbit. Slight swelling had been noticed three years before. It had slowly increased in size but had never caused discomfort until recently, when occasional dull headache began. During the past fourteen months, increasing downward displacement of the left eyeball occurred, and during the past six weeks diplopia was noted. Nasal symptoms were not present and a history of trauma could not be elicited. On examination, one was struck by the marked downward and outward displacement of the left eyeball. Exophthalmos was not present. A fluctuating swelling could be felt occupying the upper and inner angle of the orbit, and a large bony defect in the floor of the frontal sinus could easily be outlined. There was no tenderness, and the swelling could not be reduced by pressure. Intranasal examination was normal.

At operation, the symptoms closely resembled those of the previous case. The anterior and posterior walls of the sinus were intact; the lining mucous membrane was thin, and evidence of a nasal communication was not apparent. A similar operative procedure was carried out with satisfactory recovery. Cultures from the secretions were sterile.

INTRATRACHEAL INHALATION ANESTHESIA

THE METHOD OF ELECTION FOR OPERATIONS ON THE HEAD AND NECK

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The control and safety of a general anesthetic are determined by the rapidity with which it may be introduced and withdrawn from the circulation.

For this reason, volatile anesthetic agents, such as ether, chloroform and nitrous oxide, take precedence over morphine, chloral hydrate, scopolamine, etc.

If ether is employed as a liquid at a temperature below 96 F., it is found that the patient's circulation may be saturated in one of several ways. The anesthetic may be introduced into a vein by means of Ringer's solution; it may be injected into the tissues hypodermically, or it may be mixed with oil and offered for absorption by the large bowel.

As a vapor, the anesthetic may be offered for absorption by the organs especially designed for this purpose, those in the respiratory tract. The enormous surface for absorption offered by the respiratory tract (a surface equivalent to the outside surface of a balloon 18 feet in diameter) readily explains how much more quickly the circulation may be saturated by this route than by any other; and, what is more important, how much more quickly one may desaturate a circulation overburdened with the anesthetic.

The popularity, therefore, of volatile anesthetics and their introduction into the circulation by the respiratory tract is based on sound physical and physiologic principles. The use of other portals of entry, unless counterbalanced by exceptional skill and experience, results in reduced control, more frequent complications and a mortality out of all proportion to that which one might expect from the anesthetic in question. Owing to the wide margin of safety afforded by ether in the presence of free respiratory ventilation (and the recognition that much of the so-called ether after-sickness is due to anoxemia rather than to ether per se), this anesthetic not only holds its place as the most widely used general anesthetic agent, but is becoming more and more popular among physicians whose experience is most extensive. I agree fully with Miller of Providence, who, in a comparison of the after-effects of nitrous oxide oxygen and ether, concludes: "The opinion sometimes prevalent that postoperative difficulties are removed by the use of gas oxygen, or any other anesthetic agent, has no foundation. It is probable that if the same attention had been paid to improve the technique of

etherization that has been spent on other anesthetics, ether would now be recognized as the safest and most efficient of anesthetic agents." If one grants that the safest general anesthetic is the one administered in the most effective manner, namely, by inhalation, the outstanding problem is to remove by every possible improvement in technic, whatever difficulties may occur to the full enjoyment of this safety and control. In other words, one's task is to preserve the rate, the rhythm and the amplitude of the respiration which physiologically occurs when ether is inhaled.

If the trachea were extended as a rigid tube (the larynx, pharynx and mouth being eliminated) to the source of the vapor to be respired, control and ventilation would be reduced to their simplest terms and conditions for inhalation anesthesia would be ideal.

This ideal condition is fairly well approximated for anesthesia in general surgery by the employment of the pharyngeal tube (a rigid metal airway reaching from the epiglottis to the outside world).

Under present conditions of work on the nose and throat, however, ventilation is blocked by spasm of the vocal cords, the shifting of the tongue and the presence of blood and mucous as well as instruments and sponges. The sum total is often accentuated by partial flexion or torsion of the head. The patient breathes past these obstructions as best he can. If blood or an accumulation of mucous is present, he inhales this, unless it is immediately removed by suction. If a large vessel should be opened, as has occasionally occurred, the patient dies by drowning in his own blood.

By the use of insufflation anesthesia (ether vapor under pressure) and the careful and conscientious use of suction, the danger to which the patient with diseases of the nose and throat is constantly exposed may be fairly well met, the single exception being that of accidental damage to a large vessel. Unfortunately, insufflation is often inaccurately employed, and suction is used with a view of keeping the operative field clean, instead of safeguarding the freedom of the airway. Anoxemia (cyanosis) and aspiration of blood result.

Intratracheal insufflation (blowing vapor into the trachea) has been employed to meet the situation. The introduction of this method, however, implies the uninterrupted functioning of an electrically driven ether apparatus which delivers a known volume of a known concentration of ether vapor under definite pressure. Provision for the escape of this vapor must be made, resulting in an operating field filled with ether laden vapor. The method does not prevent the aspiration of blood and does not provide a means of intratracheal suction during operation. The addition of a return flow catheter unduly increases the diameter of the intratracheal tube, and does not do away with the mechanical complications presented by insufflation.

It becomes obvious that if the rigid trachea could be artificially extended through and beyond the larynx, pharynx and mouth, insufflation, with its complications, could be altogether discarded, and ideal conditions for simple inhalation anesthesia would obtain. The problem resolves itself into, "What is the largest tube which may be intubated into the larynx of the average woman and child, and remain in situ for at least two hours without trauma, or any other undesirable post-operative effect?"

SUMMARY OF PRELIMINARY REPORT

The preliminary report of this investigation [1] may be summarized as follows:

Dr. Jackson stated:

"An infant a few months old can tolerate a 4 millimeter bronchoscope, which is about 5 millimeters outside. In a child of 6 years, we use a 6 millimeter bronchoscope, about 7 millimeters outside. In an adult, we use a 9 millimeter bronchoscope, which is about 10 millimeters outside. All of the breathing is done through the bronchoscope, when a full size is used.

There is no reaction of any consequence in an operation as long as two or three hours. There is vastly more reaction from the bubbling back and forth of the ether mucous when ether is given by the open method.

It is wise always to aspirate the pharynx clear of secretions of all kinds before the inhalation tube is removed from the larynx. If this is not done, secretions will be aspirated into the larynx just as soon as your anesthesia tube is withdrawn.

It is advisable to have the larynx of patients examined with a mirror before anesthesia, particularly in every case in which it is expected to use this method of intubation. This will protect against unjust criticism. Patients often have lesions unsuspected in the larynx. For instance, one cord can be paralyzed, and yet the patient may have an excellent voice. The patient may also have tuberculosis, cancer, papillomas or other lesions. The tube will do no harm, but, it should not be blamed for things it does not do. This examination of the larynx with a mirror becomes duly important in all cases of goiter, because monolateral paralysis is often present and unsuspected. The method is especially indicated in cases of goiter, because of the fact that these patients every now and then die on the table from obstruction of the airway, due either to paralysis or to some other condition. The tube would make sure of a clear airway."

The disadvantages of the method of intratracheal inhalation are:

(*a*) The necessity of intubation by direct vision; (*b*) the presence of the intratracheal tube in the mouth.

The following advantages have been discovered:

(*a*) The elimination of complicated motor-driven apparatus, manometers and devices for warming and heating the vapor.

(*b*) An operating field free from escaping insufflated vapor.

(*c*) An operative field free from the anesthetic.

(1. Intratracheal Inhalation: Preliminary Report of a Simplified Method of Intratracheal Anesthesia Developed Under the Supervision of Dr. Chevalier Jackson, Arch. Otolaryng. **5**:385 (May) 1927.)

(*d*) Normal respiratory rhythm and amplitude.

(*e*) Conservation of carbon dioxide.

(*f*) Exclusion of foreign matter, such as blood and vomitus.

(*g*) Ability to maintain the lightest anesthesia.

(*h*) Complete control of artificial respiration by the simplest methods.

(*i*) A technic which makes available the maintenance of anesthesia for operations on the nose and throat by ether, gas and oxygen, ethylene, or any other combination of these agents.

(*j*) Protection from external pressure on the trachea.

(*k*) A method for operating on the nose and throat, which gives a field resembling that offered with the use of chloroform, with the safety of a light ether anesthesia, and protection against the aspiration of blood.

(*l*) A field of asepsis for plastic operations on the face.

THE RESULT OF PRACTICAL EXPERIENCE IN THE USE OF RUBBER TUBES IN INTRATRACHIAL INHALATION

The diameter of the wall of the rubber tube offering the necessary rigidity was out of all proportion to the lumen which the tube afforded. In other words, entirely too much airway was being devoted to rubber.

It was thought that a tube molded to the pyramidal shape of the glottis chink would be more satisfactory than a circular tube. Correspondence was opened with a European firm to this end and was abandoned, owing to a different type of improvement discovered.

Ordinary rubber tubes were found to be irritating. Special rubber that is free from sulphur is to be found and will meet this difficulty.

As the rubber tube was repeatedly boiled, it became softer and more compressible. Spasm of the vocal cords was capable of compressing the tube. Pressure from instrumentation during work in the mouth compressed the tube. The rubber tube seemed to be in the way of the operator.

The only alternative was a thin walled flexible metal tube which would afford the maximum lumen and which might be pressed into the substance of the tongue, out of the way, by a tongue depressor. Investigation brought out the fact that such flexible air-tight metal tubing has not yet been invented.

It was clear from Dr. Jackson's experience that the pressure of his bronchoscopic tube did not cause trauma or unpleasant postoperative complications.

I therefore resolved to discontinue using the rubber tubes and to begin again by constructing a tube based on the standard bronchoscope.

THE AUTHOR'S METAL INTRATRACHEAL INHALATION TUBE

A tube was therefore made up as follows:

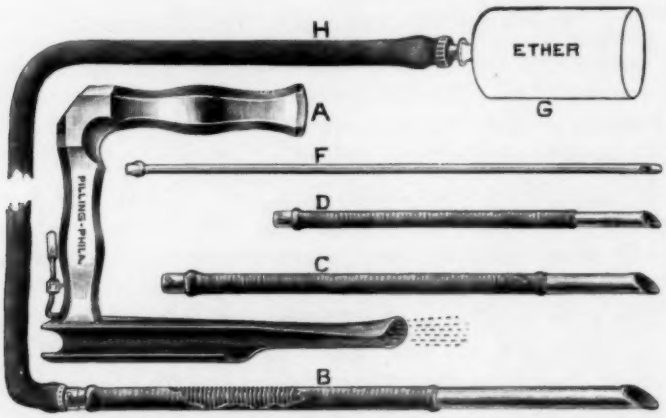
To a short section of standard bronchoscopic tubing, a length of tightly coiled spring wire was attached. The proximal end of the spring terminated in a metal coupling, which united this element with the tubing from the ether container.

The spring section was then covered up by a closely fitting section of thin rubber drainage tubing.

The piano wire originally used for the flexible tubing promptly rusted, however; a subsequent copper plating soon wore off, so it was necessary to use a special bronze wire. Intratracheal instruments are not nickelplated, owing to the tendency of the nickel to scale off.

With a view of retaining the utmost simplicity of apparatus, I made the spring wire section so stiff that the entire tube remained in a straight line when suspended by a single point. This rigidity, however, resulted in too much rebound when the tube was displaced by the tongue depressor during oral work. The other extreme was then sought for, resulting in the softest spring possible. I now use a stylet to introduce the tube. This remains in place at all times when not in actual use.

The tube is made in three sizes, consisting of 5, 7 and 9 mm. intratracheal tips. These tubes are of such a length that when fully introduced, they will terminate



A, Jackson laryngoscope; *B*, flexible rubber covered inhalation tube, with 9 mm. bronchoscopic tip; *C*, 7 mm. tube; *D*, 5 mm. tube; *F*, suction tube; *G*, ether can; *H*, connecting tubing.

about 1½ inches from the corina (the bifurcation of the trachea) in the adult, and an inch in children. In view of the fact that simple bronchoscopy is generally accepted as nontraumatic, it has seemed wise to retain the original size and shape of the standard bronchoscope, at least for the present. As the position of the tube necessarily varies with the flexion and extension of the head, it has seemed best to maintain a uniform diameter. The rigid portion of the intratracheal section is so relatively long that the tube becomes self-retaining when the head is flexed.

The spring section, about 7 inches in length, is light and extremely flexible, but noncollapsible. After operation, the rubber drainage cover is removed, permitting a thorough cleansing. This tube is readily displaced from one side of the mouth to the other in operations on the tonsils, and if desired, it may be pressed by the tongue depressor into the dorsum of the tongue, becoming entirely invisible in this position.

At the proximal end of the spring tubing is a slip connection, with a rubber tube, ½ inch in diameter, leading to the ether reservoir.

The simplest, most convenient ether reservoir is an empty ether can, used as follows:

An open ether can of any size may be used; a fourth or a half pound size usually being most convenient. Four holes, about a fourth of an inch in diameter, are punched in the top of the can by the blade of a bandage scissors. The unattached end of the rubber tubing is then slipped over the open nozzle of the can which ordinarily receives the cork. When the can is in use, a dram or two of ether is poured into one of the fourth inch holes. The patient exhales through the intratracheal tube into the can and out through the holes. During inhalation, outside air is drawn through the holes of the can, becomes laden with the ether in the bottom of the can, and finds it way up through the connecting tube and down the intratracheal tubing. Grasping the can with the hand and shaking it increases the concentration of the ether vapor.

While the simplicity of this device may lend an air of crudeness, practical experience proves it to be safer and more effective than more complicated apparatus, especially in view of the fact that most work on the nose and throat is done in the dark, when visual measurements are practically worthless.

PROCEDURE

A preliminary hypodermic injection of $\frac{1}{6}$ grain (0.01 Gm.) of morphine and $\frac{1}{150}$ grain (0.4 mg.) of atropine forty-five minutes before operation reduces salivation and tracheal irritability. The patient is completely induced with gas and ether to full relaxation.

The intratracheal tube with the stylet in place and the sterilized connecting tube and laryngoscope are at hand.

The inhaler and the pharyngeal tube are removed.

The patient's head is extended.

The laryngoscope is grasped in the left hand.

The fingers of the right hand separate the lips and the teeth, and guide the laryngoscope over the tongue.

The epiglottis is exposed.

The tip of the laryngoscope passes just beyond the epiglottis and, lifting the tongue and epiglottis, exposes the larynx.

By direct vision, the tube is then introduced without force between the vocal cords. If spasm occurs, the cords will be found to separate on inhalation.

The stylet is then removed from the intratracheal tube, the laryngoscope is then removed, and the head is flexed. The patient will then be found to be breathing quietly through the tube. The connecting tube is then attached, and a little ether poured into the can and shaken.

COMMENT

Laryngeal exposure under ether is easier and trauma is less likely to occur than in conscious patients.

Muscular relaxation allows the use of a common laryngoscope for children and adults.

Anesthesia permits a more deliberate intubation than ordinary bronchoscopy. The result is greater safety.

The patient who is anesthetized for an operation on the nose or throat must always be completely induced, if his maintenance is to be satisfactory. Therefore, the induction of anesthesia is not necessarily prolonged.

Intubation may be accomplished in a few seconds if proper exposure is accomplished.

From the moment of intubation, the patient with his head flexed falls under complete anesthetic control, a control that is not affected by subsequent operative procedure or position.

A comfortably fitting intratracheal tube, insuring free airway, seems safer and less likely to cause trauma than one which packs the larynx tightly. Blood clots or solid matter cannot pass by the side of the intratracheal tube.

Fluid, blood or mucous which follow down the sides of the tube soon become evident in the sound of the respiration. This fluid is readily and completely removed by a suction catheter slipped into the intratracheal tube as required.

The lighter the patient, the tighter his cords grip the tube, and the safer he is against leakage around the side of the tube.

Respiratory spasm on intubation is largely controlled by full etherization and preliminary medication.

REPORT OF CASES

Records of new anesthetic methods and agents are accumulated to bring out, first, the safety of the new procedure—its freedom from immediate and remote ill effects and second, its special advantages over other methods, as seen from an anesthetic and surgical point of view.

As the laryngoscopic technic prescribed by Dr. Jackson has been strictly adhered to and as his standard bronchoscopic tubes have been employed as the vital element of the apparatus (the intratracheal portion), this method rests on the firm foundation of an unequalled experience and technic. Dr. Jackson states that there is no reaction of any consequence in an operation which lasts as long as two or three hours and that there is vastly more reaction from the bubbling back and forth of ether mucus when ether is given by the open method.

Accepting this judgment as final, I have not hesitated to employ intratracheal inhalation as a routine method in my private work.

The limited number of cases reported up to date (between 75 and 100) include, however, those of men, women and children as young as 3½ years. Following intubation, the anesthetic control of the patient has been little short of marvelous, bearing out in actual practice the theoretical advantages anticipated. Included in the cases reported to date are several of pansinusitis and submucous resection and some in which nasal plastic operations were performed.

Two cases in which resection was done are of interest.

CASE 1.—A child, aged 8 years, was operated on for submucous resection. The patient was anesthetized by the house physician with the open ether method; a no. 5 tube was intubated without difficulty. The operation proceeded without the use of the posterior plug. As a consequence, the pharynx promptly filled up with blood. As fluid blood leaked passed the intratracheal tube into the trachea, it was promptly removed by a small suction catheter slipped into the trachea tube. During the entire operation, neither oral nor pharnygeal suction took place, owing to the necessity of suction in the nasal field. This case demonstrates an extreme condition of respiratory obstruction, which could not have been tolerated without the presence of an intratracheal inhalation tube.

CASE 2.—The patient, a woman, had a short neck and was highly nervous. The laryngoscope showed a small glottic chink, which, however, accepted a no. 7 tube. From the time of intubation, the respiration was free, regular and so quiet as to be inaudible. A posterior plug was introduced; the patient's head was slightly elevated, and intranasal cotton pledgets of epinephrine were introduced. The operation proceeded subsequently with so little bleeding and disturbance to the surgeon, that he remarked: "I did not believe that such a condition was possible with nasal work under ether anesthesia." The intratracheal tube remained dry throughout, and subsequent convalescence was uneventful.

CASES 3, 4 and 5.—On November 14, in a woman and two large men the adenoids and tonsils were removed. A no. 9 tube was acceptable in each case. The anesthesia throughout the operations, in which the Schulter method and dissection were employed, presented a tranquil intratracheal respiration with full oxygenation, while blood pooled in the pharynx and the usual intrumentation and sponging were in progress.

Two cases brought out Dr. Jackson's contention that ether-laden mucus produces irritability of the larynx.

CASE 6.—On April 18, the patient was operated on for pansinusitus. He developed sharp respiratory spasm, owing to the accumulation of discharge in the pharynx from the sinuses. This spasm rendered laryngoscopy difficult and the cords irritable. This irritation, however, passed off with intubation.

CASE 7.—During the operation, November 14, this patient experienced much the same respiratory difficulty during the induction of the anesthesia as did the patient in case 6. Laryngeal spasm brought about by the discharge from the sinuses made it extremely difficult to relax the patient sufficiently to expose the larynx. On intubation, the larynx was found to be extremely irritable. A few moments after intubation, however, intratracheal suction was applied through the intratracheal tube, and the patient passed rapidly and quietly to a satisfactorily anesthesia, under which he remained for approximately two hours.

The recovery in each case was rapid and uneventful.

My practical experience confirms my impression that from the point of view of anesthetic control intratracheal inhalation is, with few exceptions, the method of election for all operations on the upper air passages.

It was a surprise to find that the intratracheal tube is not in the surgeon's way in operations on the tonsil or in other oral work. As

the tube is noncollapsible and self-retaining, it may be pushed out of the way and disregarded. Manipulation and support of the tongue to maintain respiration is no longer necessary. If an exposure is secured, it may be maintained as long as it is desired, for interruption of the respiration cannot occur. The usual haste and tension of the operation on the tonsils no longer obtain. Operations on the nose and throat may become deliberate and leisurely procedures. Bleeding is reduced and is no longer artificially exaggerated by the blowing of anesthetic vapor through the operative field. The surgeon operates in a field fully and continuously oxygenated and free from the odor of ether vapor.

SUMMARY

Intratracheal intubation by the Jackson bronchoscope, in accordance with the prescribed technic, is a comparatively simple and nontraumatic procedure.

The extratracheal portion of the standard bronchoscope has been modified to form a flexible airtight, noncollapsible, self-retaining inhalation tube, which can be attached to the source of the ether, chloroform nitrous oxide, or whatever anesthetic is used.

The anesthetic control afforded by this adaptation approximates the ideal which would exist if the open trachea were extended through and beyond the operative field.

The adoption of intratracheal inhalation, as prescribed, is calculated to change the complexion of operations on the upper air passages by reducing the customary tension and haste of these operations, by insuring full, continuous unobstructed respiration which results in a lowered blood pressure and the reduction of bleeding at the operative site, by preventing the accidental aspiration of blood, vomitus, mucus, sponges, tissue, teeth, etc., during operation and thereby protecting the patient from postoperative pulmonary abscesses.

Clinical Notes

OTALGIA FROM ABSCESS OF THE TONGUE CONTROLLED BY COCAINIZATION OF THE NASAL GANGLION*

FRENCH K. HANSEL, M.D., ST. LOUIS

Although abscess of the tongue is not an extremely rare condition, there are two unusual features about the following case which warrant its being reported; first, the onset was characterized by pain in the pharynx and ear without pathologic changes occurring for three or four days; second, the pain in the ear and pharynx could be stopped by cocainization of the nasal ganglion.

REPORT OF CASE

A man (H. C.), aged 52, a clerk, was first seen on July 23, 1926. He complained of a sore throat which had begun ten days previously. For three days, the pain had been localized in the left side of the pharynx, and he had had a sharp, momentary stabbing pain in the left ear whenever he swallowed. The results of examination of the pharynx, larynx, nasopharynx, nose, mouth and ears were essentially negative.

Cocainization of the left nasal ganglion with one drop of saturated solution of cocaine stopped the pain in the pharynx and in the ear. The patient was dismissed and asked to return for observation. The condition seemed to be glossopharyngeal neuralgia, as a trigger effect was produced when he drank cold water.

Three days later he returned, complaining of a slight stiffness in the tongue, a metallic taste and an increase in the intensity of the pain in the left side of the pharynx and in the ear. On palpation of the base of the tongue, some tenderness could be elicited, but swelling and ulceration were not noted.

The nasal ganglion was again cocainized, with control of the pain in the ear. The patient was informed that he was probably developing an abscess of the tongue.

The following day some definite thickening could be felt in the deep substance of the left half of the tongue. The pain was more marked, and swallowing was not only difficult, but extremely painful.

The patient was instructed to apply hot saline irrigations to the mouth and pharynx every two hours. During the subsequent eight days, the swelling and induration in the deep substance gradually increased until the floor of the mouth began to bulge upward. Then definite fluctuation was demonstrable, and it was decided to open the abscess. A small incision was made in the posterior part of the floor of the mouth along the border of the tongue. A curved forceps was introduced to a distance of about 2 cm. before the abscess was reached. About an ounce of foul-smelling pus was evacuated. Cultures of the pus showed staphylococci but not actinomyces.

The abscess cavity was drained for about two weeks; then all induration gradually disappeared, and the patient was pronounced well.

The reflex pain in the ear, associated with the abscess of the tongue in this case, was probably transmitted either through the fifth or ninth nerve.

* From the Department of Oto-Laryngology, Washington University Medical School.

The pain in the ear seemed to arise in the base of the tongue and in the wall of the pharynx below the tonsil. The pain was sharp, paroxysmal and lasted only a few seconds. It was brought on by talking and swallowing. These paroxysms were identical with glossopharyngeal neuralgia in all of its characteristics. It appears, therefore, that the reflex pain was transmitted by the glossopharyngeal nerve.

Reflex pain in the ear from pathologic conditions in the tongue, such as carcinoma, is not unusual, but the control of the pain in the ear, associated with abscess of the tongue, by cocainization of the nasal ganglion has not been reported. A number of pathologic conditions are known to produce pain in the ear.

Otalgia has also been noted as a result of extraction of teeth, impacted wisdom teeth, fracture of the jaw, nasopharyngeal tumors, tonsillectomy, carcinoma and tuberculosis of the larynx.

In Sluder's[1] monograph on "Nasal Neurology, Headaches and Eye Disorders," he refers to cases of otalgia caused by carious teeth and tonsillectomy in which the pain could be stopped by cocainization of the nasal ganglion.

Clerf[2] proved that earache associated with carcinoma of the larynx could be controlled through the nasal ganglion. Gundrum[3] did likewise in cases of earache associated with tuberculosis of the larynx.

A NEW TREATMENT FOR VINCENT'S ANGINA

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In the discussion of a paper on Vincent's angina at the meeting of the Southern Medical Association in Atlanta, in 1926, it was brought out that the spirillum was gram-positive and that the bacillus was gram-negative. It occurred to me that if this were true, acriviolet, which is a combination of acriflavine, for the gram-negative organism and gentian-violet for the gram-positive organism might be effective in Vincent's angina. The first case in which I tried the new treatment was not severe, and the condition cleared up immediately. In the second case the disease had progressed for about six weeks. The tonsils had sloughed considerably, and there were ulcers on the soft palate and about the molars. To my great surprise, there was marked improvement within twenty-four hours, and the patient was well in less than a week. My co-workers and I have used this treatment in all cases since then with equally good results.

A 2 per cent solution of acriviolet can be kept on the treatment desk, and if the patient can reach the ulcer, he may apply the solution himself. One application a day will relieve the patient of pain in about two days, and will effect a cure in about five days. So far in my experience this has been a specific treatment for patients with Vincent's angina.

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1. Sluder, Greenfield: Nasal Neurology, Headaches and Eye Disorders, St. Louis, Missouri, C. V. Mosby Company, 1927, Chapter VII.

2. Clerf, L. H.: Control, Through Nasal Ganglion, of Earache of Laryngeal Origin, J. A. M. A. **82**:630 (Feb. 23) 1924.

3. Gundrum, L. K.: Pain from Tuberculous Laryngitis Relieved by Cocainization of the Nasal Ganglion, J. A. M. A. **83**:998 (Sept. 27) 1924.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

ANATOMY AND PHYSIOLOGY OF THE EAR

REVIEW OF THE LITERATURE FROM OCTOBER, 1926, TO OCTOBER, 1927

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BOSTON

The review of the literature is again presented in abstract form. Almost all of the articles are based on experimental observations by authoritative investigators. The past few years have been particularly fruitful ones, owing to the enthusiasm displayed in the investigation of the physiology of the labyrinth. This enthusiasm naturally leads to controversy, and as controversy results in keener analysis I can hopefully say that knowledge concerning the physiology of the labyrinth will be placed in a less assailable position, as far as otologists are concerned, and will permit the carrying on of tests on a more rational and secure basis.

GROSS AND APPLIED ANATOMY

Kiss [1] studied the squamous portion of the temporal bone situated at the root of the zygomatic arch, particularly at the lower border of the temporal fossae. Between the two lamellae of bone, he says, is found a spongy substance filled with red bone marrow. He discusses the connection of the tympanic cavity with the temporal fossa and remarks concerning the importance of this medullary space.

In a much pneumatized temporal bone, the anterior cells of the tympanic cavity settle directly in the medullary region. Small veins go out from the spongy space toward the temporal fossa, where they empty into the larger veins of the temporal muscle. Their small openings (two, three, five and eight in number), the size of a pinprick are always to be found in the lowest region of the temporal fossa. One or two small veins may make their way backward toward the cranial cavity. Infective material on one side also may reach the temporal fossa (formation of abscess above the zygomatic arch) in the same way, but on the other side, there is also the possibility of an infection of the cerebral meninges through which venous connective passages lead into the meningeal veins. Many a case of meningitis may originate in this way.

Claoue [2] discussed, in an instructive way, the origin of the labyrinth capsule and the perilabyrinthine cell groups. He also discusses the

1. Kiss, F.: Ztschr. f. d. ges. Anat.; abstr. Ztschr. f. Nat. u. Entwicklungsgesch **81**:618, 1926.
2. Claoue, C.: Oto-rhino-laryngol. internat. **11**:5, 1927.

vessel supply of the labyrinth and attributes the formation of sequestrums to multiple thrombosis of the branches of the internal auditory artery and the vessels of the middle ear.

Mouret [3] describes the "foot" of the squamous bone and its connection with the ear and suppuration of the ear. By "foot" of the squamous portion of the temporal bone, Mouret means the lower part of that bone through which it contributes to the base of the cranium, and participates in the formation of the mastoid process, tympanic cavity, outer auditory canal and the temporomaxillary articulation. Divergences from the normal structure, which are manifested in dehiscences and openings from sutures, are also considered. A series of photographs and sketches are given, the latter in the form of sections for the purpose of establishing the relations of the bone to the dura, sinus, carotid and labyrinth of the ear.

Mineff [4] describes the topographic anatomy of the mastoid antrum. The author dissected twenty-five temporal bones and studied the relation of the mastoid antrum to the transverse sinus, the facial nerve and the temporal line. He maintains that the temporal line cannot serve as a limit for the determination of the position of the antrum, and that its relation to the antrum is not constant. He finds, on the contrary, that the superior meatal spine forms a constant point for determining the location of the antrum. This article could hardly be considered as an anatomic contribution because of the limited number of dissections that were made.

Guild,[5] investigating the circulation of the endolymph, employed the experimental methods used by Weed and by Wefefarth for the circulation of cerebrospinal fluid. He states that endolymph is formed by the stria vascularis and flows toward the basal end of the cochlear duct, then through the canalis reuniens into the sacculus and from this through the ductus endolymphaticus into the saccus, leaving the membranous labyrinth by passing through the wall of the pars intermedia (lined by columnar epithelium) of the saccus into the numerous small vessels of the region. Thus the saccus is not vestigial, but is the site of main drainage of fluid out of the system; this is comparable to the flow of cerebrospinal fluid through the arachnoid villi. The relation to deafness is discussed.

Romano [6] gives the description and topographic anatomy of the "musculus-tympano-salpingo-staphylinus" in human beings. In his rather complete and well illustrated description, he describes together

3. Mouret, J.: Ann. d. mal. de l'oreille du larynx. **46**:101, 1927.
4. Mineff, M. T.: Jahrb. d. Med. Fak. Univ. Sofia. **6**:155, 1926.
5. Guild, S. R.: Am. J. Anat. **39**:57, 1927.
6. Romano, S.: Val salva **2**:506, 1926.

under this name the "musculus-tensor-tympani" and the "musculus tensor-veli-palatini," which are usually described as two separate muscles.

Koerner [7] describes the septum petrosquamosum mastoideum and remarks on its clinical significance. He says that during the development and growth of the mastoid process, the cell system emanating from the antrum and squamosum remains separated by a bony wall from the cell system emanating from the antrum petrosum; this wall may persist into later life. This septum explains why there is sometimes more or less isolated disease in the region of the petrosal cells or of the squamous cells. It is also possible to have isolated infection in both regions with a healthy area between the zygomatic region and the tip.

DEVELOPMENTAL ANATOMIC DEFECTS

Fraser [8] describes a case of malformation of the bony and membranous labyrinth on both sides in a boy, aged 5 years, who died of status lymphaticus. The right ear showed developmental errors in the bony and membranous labyrinths, while the left showed a rudimentary vestibule and cochlea in which the neuro-epithelium and semicircular canals were absent. The condition on the left side appeared to approach Michel's type of sporadic congenital deafness in which the inner ear is absent owing to nonformation of the otic vesicle. A complete set of photomicrographs showing the defects illustrates the article.

Greig [9] describes the skull which shows bilateral congenital absence of the tympanic element of both temporal bones. By way of introduction, he gives the normal development, and then proceeds to show that absence of the tympanic element will be associated with:

(*A*) Primary defects
- (*a*) Absence of tympanic membrane
- (*b*) Absence of external acoustic meatus
- (*c*) Deficiency in the bony portion of the auditory tube
- (*d*) Absence of the vaginal plate of the styloid process

(*B*) Secondary defects
- (*a*) Absence of auditory ossicles
- (*b*) Modification of the auricle
- (*c*) Defective pneumatization of the mastoid.

Krukover [10] reports a case of congenital bilateral malformation of the ear (arrested development). It is a bilateral congenital smallness of the external ear with deep bony atresia of the auditory canal and defects of the eustachian tubes and the tympanic cavity. There is also arrested

7. Koerner, O.: Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:137, 1927.
8. Fraser, J. S.: J. Laryng. & Otol. **42**:315, 1927.
9. Greig, D. M.: J. Laryng. & Otol. **42**:309, 1927.
10. Krukover, I.: Vestnik rino-larnigo-otiatrii. **6**:36, 1926.

development of the tympanic part of the temporal bone, as well as atresia of the opening of the left posterior nares.

Hoffman [11] cites a case of malformation of the ear in a premature male child (8 months). The malformation involved all three parts of the right ear, mostly the outer and middle ear. The adjoining cranial parts were also involved (defect of hyperplasia of the right superior maxilla, aplasia of masseter and temporal muscle). The malformation of the ear presented itself as a forward dislocation of the auricle on the cheek combined with severely arrested development. The case was therefore one of "cheek-ear" with severe microtia.

Besides this, two preauricular vestibules were found, as well as atresia of the auditory canal. The middle ear was also deformed, with an irregular structure of the medial tympanic wall and absence of the auditory ossicle and of the pars tympanica as well as of the tubular wall.

COMPARATIVE ANATOMY

Michelovic [12] gives a preliminary report based on studies in comparative anatomy of the vestibule of the ear. The parts chiefly examined were the ampullae, utricle, sacculae, cristae and maculae. He finds that there are no essential differences in these parts in the different species of animals. The anatomy, experimental observations and clinical experience would indicate that the higher the phylogenetic development of the species, the less important is the part played by the vestibule in some groups of vertebrates. The function of the otoliths, at least in mammals, is not due to their weight and structure, but to biochemical processes which take place around them. In fishes, the otoliths probably function because of their weight.

Gray [13] describes an aqueduct in the bird's labyrinth not previously recorded, and remarks about its evolutionary significance. He says that the structure consists of a fine canal running through surrounding bone from the ampulla of the posterior canal to the recessus perilymphaticus. The canal therefore allows the perilymph to pass from the posterior ampulla into the recessus perilymphaticus, and from there into the cranial cavity and also into the cochlea. It is a short tube and varies in caliber from 0.6 to 1.2 mm. in length and from 0.2 to 0.25 mm. in diameter. The physiologic importance of this little aqueduct is probably small, but its evolutionary significance appears important, which the author demonstrates in his excellently illustrated article.

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11. Hoffman, L.: Monatschr. f. Ohrenh. **61**:509, 1927.

12. Michelovic, M. S.: Zurnal usnych nossorych i gorlovych-bolesnej **3**:639, 1926.

13. Gray, A. A.: J. Laryng. & Otol. **41**:710, 1927.

Federici [14] points out that the macula lagenae, which is situated at the end of the cochlea in birds, is innervated by vestibular fibers in which the ganglion cells in communication with these fibers, in contrast to the fibers of the adjacent papilla basilaris, constitute all the larger characteristic vestibular ganglion cells. He means that this macula, originally phylogenetic, like the other two maculae, is innervated from the vestibular nerve, and that the papilla basilaris is a new formation inserted between the other two terminal spots.

According to his investigations, the paratympanic organ of Vitali is also innervated by a bundle of vestibular fibers and is attached only to the facial nerve. He believes the function of the organ is paresthetic. He further calls attention to the fact that in the head of the bird, the macula lagenae lies in the sagittal plane and vertical to the plane of the other two maculae. He considers the macula lagenae as a mechanism which enables the bird to judge the inclination of the wing to the axis of the body and to gravitation. He describes the gyroscopic apparatus which permits aviators to recognize this mechanism.

Endoh's [15] experiments on rabbits indicate that there is a connection between the facial and the eighth nerve. By avulsion of the nervus facialis, he demonstrates pathologic transformation of the geniculate ganglion and of the anterior vestibular ganglion, especially a secondary degeneration of the connective element.

The cerebral conditions after the same manipulation show that the microscopic changes in the nuclear region of the vestibular nerve are considerably slighter than in the nuclear region of the facial nerve. Here the decrease in function in the root of the vestibularis appears moderately distinct, while that of the cochlearis remains completely intact.

The author finds from the results of his experiments that the connections between the facial nerve and the vestibular nerve are formed by four factors: geniculate ganglion, connective nerve fiber fasciculus and ganglion cell chain and superior vestibular ganglion.

HISTOLOGY AND EMBRYOLOGY

Bast [16] gives a preliminary report on the early development of the bony capsule of the human ear and shows two models of the internal ears of two human embryos, aged 17½ and 19½ weeks, respectively. Serial sections of a 16 week embryo is also demonstrated. He observes: 1. The first centers of ossification occur at the origin of the cochlea and the points where the branches of the vestibular nerve enter the ampulla of the semicircular canal. The center of ossification around

14. Federici: Rev. d'oto-neuro-ocul. **4**:721, 1926.
15. Endoh, J.: Folia Anat. Japonica **5**:9, 1927.
16. Bast, T. H.: Laryngoscope **37**:652, 1927.

the ampulla of the posterior canal and the one at the origin of the cochlea soon unite to form an incomplete ring of bone around the fenestra rotunda. 2. While the foregoing centers lie close to, and partly around, the fenestra ovalis, they are formed independently and are unrelated to the formation of the oval window. At the time when the ossification process has extended all over the capsule, there still remains an area of unossified cartilage between the footplate of the stapes and the bone in the region of the first center of ossification.

Guild [17] gives a detailed study of the dimensions and epithelium of the internal ear, which leads to the demarcation of distinct parts: (1) the ductus endolymphaticus proprius, the narrow portion of the membranous labyrinth extending from the sacculus through the proximal part of the aquaeductus vestibuli, lined by squamous epithelium, and (2) the saccus endolymphaticus propius, from the beginning of the funnel-like expansion to include all distal thereto, irrespective of its relation to the bony canal. The saccus is subdivided into three parts, of which the pars proximalis is lined by squamous cells, the pars intermedia with a predominance of columnar epithelium devoid of a basement membrane, and the pars distalis, which overlies the transverse sinus in the dura mater, with a lumen open or potentially so, and lined by thick squamous epithelium. Numerous free cellular elements are seen in the lumen of the saccus, and their source is discussed. The evidence for and against postnatal growth of the internal ear is not conclusive.

Kolmer [18] answers Wittmaack's criticism of his description of the relation of the covering membranes to the sensory epithelium of the labyrinth terminals. It concerns chiefly the relation of the gelatin substance to the sensory hair cells.

Wittmaack says that the covering membrane of the maculae and cristae was produced as follows: "The sensory hairs passing out from the sensory cells divide into many branches at some distance from the epithelium and excrete the gelatin from these branches so that they themselves are connected with the gelatin." But the author found by embryologic examination that the distal and oldest part of the gelatin was formed by all the sensory and supporting cells of the anlage of the nerve terminals, that later only the supporting cells produce gelatin so that the latter is finally connected by delicate threads with the heads of the supporting cells; the sensory hairs and the flagellae beside them, which Wittmaack did not see, project into the spaces above the hair cells which remain empty and form short canals in the macula and long ones in the crista. Wittmaack is right in saying that the gelatin is

17. Guild, S. R.: Am. J. Anat. **39**:1, 1927.

18. Kolmer, W.: Arch. f. Ohren-, Nasen- u. KehlKopfh. **116**:10, 1926.

attached to the heads of the transitional epithelial cells which surround the terminals, but these cells do not have any hairs.

The preservation of the otoliths and otolith membranes at the different terminals is more or less a matter of chance even with the best technic, and cannot be accomplished uniformly in every case. Wittmaack's opinion that the membrana tectoria also has a fixed connection with the hairs of the sensory cells of Corti's organ or even with Hensen's cells in the sexually mature animal could not be confirmed even in the best specimens, and the threadlike connections with the cells of the papilla basilaris which was sometimes seen in cats, but rarely in man, must be regarded as abnormal remnants of embryonic connections as described by Held.

Alexander [19] demonstrates four types of mucous membrane of the middle ear, as described by Steurer and by himself, in one and the same temporal bone. This article is also controversial in nature, as Wittmaack challenged Alexander to demonstrate these four types. For this purpose, Alexander examined a number of sectioned series with entirely normal middle ears. Among these were specimens that were fixed a few hours after death. He not only was successful in finding several types of mucous membrane in the same case, but occasionally even in the same section.

Cipollone [20] found in recent histologic specimens of the membranous labyrinth of fowls that there is a direct connection between the ampullae of the semicircular canals and the recess of the utricle. He now believes that the pressure and traction of the endolymph on the ciliae of the cristae, which he thinks are rigid, is the cause of stimulation of the ampullar sense organs. He also makes a report of the structures of the two peripheral vestibular (Bottcher's and Scarpa's) ganglions in different animals and in man, and discusses the possible significance of these ganglions in the occurrence of secondary nystagmus in abnormal stimulation of the labyrinth, as well as in pathologic labyrinthine dizziness. He also describes the course of the tympanic nerve and the region innervated by it. He believes that by its connections with the various ganglions it is capable of bringing about various reflexes that regulate the cooperation between the tensor tympani muscle and the muscles of the soft palate and tubes.

PHYSIOLOGY OF THE COCHLEA

Scripture [21] proposes that hearing is based on the following two principles: 1. Repetition of the impacts of air produces the sensation of tone. 2. The height of the tone depends on the form of the air

19. Alexander, G.: Monatschr. f. Ohrenh. **61**:446, 1927.
20. Cipollone, T. L.: Valsalva **3**:101, 1927.
21. Scripture, E. W.: Monatschr. f. Ohrenh. **61**:199, 1927.

impact. The complete independence of these two psychic phenomena was strikingly demonstrated by an experiment made by Fletcher. A vowel was sung into a telephone; certain vibrations were prevented from being transmitted by means of a cribriform plate. The examiner listened at the other end of the phone. The tone was produced by repetition of the physical impact of the sound, but by changing the form of the wave by means of the cribriform plate, the quality of the sensation was changed.

The author tries to work out a theory of the mechanism of the internal ear in harmony with these demonstrated facts. By means of the tympanic membrane and ossicles, the vibrations of air are transformed into the parallel mechanical movement of the stirrup. The mass movements of the labyrinthine fluid take place not only along the canal, but also transversely through the fissure. This produces complex forms of movement of the fluid which are dependent on the form of the physical impacts of air. The basilar membrane lying over the fissure must follow the movements of the fluid. This causes a movement of the membrane that varies at different times; it is called a sound picture. Every such sound picture corresponds to a certain physical form of wave. The series of physical air impacts causes a series of sound pictures. Several thousand nerve terminals are situated on the supporting fibers of the whole delicate membrane, which constantly transmit the condition of the membrane to the brain. The three dimensional movements of the membrane appear in consciousness as a sensation of quality, the repetitions as sensations of tone.

Bonain [22] has a new theory of hearing. He believes that the tympanic membrane and the auditory ossicles cannot be set into transverse vibration by the sound waves of the air, the amplitude of which is generally very small. But the longitudinal waves on normal air conduction pass through the tympanic membrane, the tympanic cavity and the fenestra rotunda into the cochlea and here through the arcuate zone of the basilar membrane and the inner tunnel to the covering membrane. Transverse vibrations do not develop until this membrane is reached, and they transmit to the hair cells a stimulation corresponding in form and amplitude to the entering wave.

The middle ear serves for accommodation to different strengths of sound; on a weak stimulus, the tympanic membrane relaxes and arches outward. An outward movement of the ossicles follows, while the fenestra rotunda arches inward toward the cochlea. In this way, the posterior part of the tympanic cavity forms an acoustic biconvex lens which collects the sound waves. On a strong stimulus, the reverse position of the middle ear is brought about reflexly by the muscles of the

22. Bonain, A.: Ann. d. mal de l'oreille, du larynx **45**:1108, 1926.

middle ear; the tympanic cavity forms a biconcave lens which disperses the sound waves and so weakens them.

Held and Kleinknecht [23] describe a method worked out by Held by means of which a change of tension of a narrow strip of the basilar membrane can be brought about in guinea-pigs without injury to Corti's organ. The gaps in the hearing of tones, which are described in detail and illustrated by curves, correspond with sufficient accuracy to the ones that have been calculated, so far as it is possible to make an accurate calculation of them. The results also agree sufficiently with the experiments in degeneration in tone fields made by other authors. Among the different theories of hearing, the results agree best with Helmholtz' theory.

Jannuzzi [24] discusses some of the peculiarities of the labyrinths of birds and their physiologic significance. The author gives Scarpa the credit for having demonstrated the communications between the posterohorizontal and posterovertical semicircular canal at their crossing. There is a foramen in both of the bony semicircular canals; in the fresh specimen, it is closed by a fine periosteal membrane, the same periosteum that lines the inner surface of the semicircular canals. This membrane, according to Scarpa, serves to sharpen hearing, as it strengthens the tones by its vibrations. The author studied many species of birds, as well as wild and domestic fowls. In all the cases, he found the openings in the bone and a closing membrane described by Scarpa; it was transparent, opaque or rosy, depending on the age of the animal. In doves from 3 to 6 months of age, he found that this transparent occluding membrane enters into active vibration when a tuning fork is struck near it. In doves from 2 to 4 years old, particularly male doves, the membrane was opaque and the vibrations less visible. Like Tullio, the author found that the animals become less sensitive to tones as they grow older, and that the semicircular canals also serve in localization of the tones.

Kakeshita [25] made observations on guinea-pigs and on cats to determine the central localization of the cochlear reflexes. After producing various lesions, he was able to demonstrate that there are reflex responses to sound even after removal of the mesencephalon. Lesions of the striae acousticae and of the trapezium appear to be without effect.

PHYSIOLOGY OF THE LABYRINTH SHOWN BY EXPERIMENTS

Chilow [26] studied the otolith function in amphibia and fishes. After tadpoles, tritons, minnows, carp and smelts were centrifugalized, they

23. Held, H., and Kleinknecht, F.: Arch. f. d. ges. Physiol. **216**:1, 1927.
24. Jannuzzi, S.: Arch. ital. di. otol. **37**:696, 1926.
25. Kakeshita, T.: Arch. f. d. ges. Physiol. **212**:769, 1926.
26. Chilow, K. L.: Ztschr. f. Hals-, Nasen-u. Ohrenh. **16**:452, 1926.

made movements for a little while, but then remained quiet. All the animals assumed an upright position in water with their heads up. Only the carp assumed a position with their heads down, but the animals could not orient themselves, so that it would seem that the otoliths are organs concerned with positions in space. In fishes, the otoliths are a reflex organ of position connected physiologically with the air-bladder. When the pressure of the water is changed, the otoliths are stimulated, as a result of which there is dilatation of the swimming bladder and a decrease of the specific gravity of the fish. After being centrifugalized, the fishes are indifferent to changes of pressure in the water, while normally they try to rise when there is an increase in pressure.

Thornval [27] performed two sets of experiments on doves. In one group, he examined spontaneous nystagmus after operation on one side, leaving the other untouched. In the second group, he tested the flow in the individual semicircular canals on one side before and after performing labyrinthectomy on the other side. On examining spontaneous nystagmus in the right and left lateral positions in doves in which all the ampullae and the otolith sacs had been removed on the right side, he found that the doves showed the strongest nystagmus in the left lateral position; after plugging of the semicircular canals on the right side, he found the nystagmus for the first few days after the operation was almost always strongest in the left lateral position. On removing the ampullae and otolith sacs on the left, he found that the nystagmus was strongest in the right lateral position.

Therefore, when a total labyrinthectomy is performed on one side, the compensatory disturbances are most marked when the animal lies on the normal side. The same is true when the semicircular canals are plugged on one side. It seems, therefore, that the tonus of the semicircular canals and otoliths of the sound side seems to be greatest when the animal lies on the normal side. Thornval concludes that this could be explained only on the assumption that under normal conditions an inhibiting influence is exercised on the tonus of the left semicircular canals from the right otolith apparatus in the left lateral position, while in the right lateral position the tonus of the left semicircular canal is increased.

Versteegh [28] reports the results of partial extirpation of the labyrinth in rabbits. The anatomic division of the labyrinth into a superior part with semicircular canals and utricle and into an inferior part with sacculus and cochlea, separated from each other by a limiting membrane, has a physiologic significance.

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27. Thornval, A.: Acta. oto-laryng. **11**:169, 1927.
28. Versteegh, C.: Acta. oto-laryng. **11**:392, 1927.

After the inferior part is opened, whereby endolymph and perilymph escapes from this part, a transitory loss of tonus of the extremities takes place on the operated side (Arndts, MacNally).

After complete destruction of the sacculus maculae, on one as well as on both sides, all the vestibular reflexes so far known can still be evoked. The only deviation that was noticed was a slight decrease in the total rotation.

Groebbels [29] describes the disturbances in posture reflexes and movement reflexes that occur in the tame pigeon following unilateral and bilateral removal of the semicircular canals and of the ampullae.

A foundation is established for the view that these disturbances are due to an injury of the crista acoustica and its central connections, which are characteristic for each of the three ampullae.

It was demonstrated that all of the observed manifestations may be grouped into three categories: primary phenomena of irritation, primary abolition of function and secondary phenomena of irritation. The last category is due to a reciprocal influence of both labyrinths.

Benjamins and Huizinga [30] made experiments with pigeons and found that when the head is turned the eye rotates in the normal pigeon; the maximum mean value of this amounts to 14.3 degrees. Great individual differences occur. The curve regularly runs through a maximum and a minimum position, such as occurs in other experimental animals.

The vertical movements of the eye are not pronounced in the pigeon, nor does the pigeon show any tonic cervical reflexes on the eyeball. Rotation of the eyeball disappears following bilateral removal of the labyrinth. In the pigeon, the rotation of the eyeball is strongly influenced by the homolateral labyrinth. After the entire superior part had been removed on both sides, there was still a rotation of normal degree in several pigeons. Rotation disappears after removal of the entire inferior part on both sides. After removal of both lagenae, rotation remains intact.

Rotation in the pigeon is evoked by the sacculi. It was impossible to determine a definite O-position of the eyes in the pigeon. Rotation of the eyeball is considerably greater in revolutions around the frontal axis than in revolutions around the sagittal axis. This is still manifest even after unilateral extirpation of the labyrinth.

The last mentioned fact, as well as the course of the curves for normal pigeons, can neither be brought into accord with the pressure theory nor with the suspension theory of the effect of the otoliths.

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29. Groebbels, F.: Arch. f. d. ges. Physiol. **214**:721, 1926.
30. Benjamins, C. E., and Huizinga, E.: Arch. f. d. ges. Physiol. **217**:105, 1927.

McNally [31] observed that division of any two of the first three cervical roots in rabbits leads to rotation of the head to the opposite side. Rotation of the head resulting from unilateral labyrinthine lesion is effected from the other labyrinth by impulses that cross in the spinal cord.

PHYSIOLOGY OF THE SEMICIRCULAR CANALS AND OTOLITH APPARATUS

Mygind [32] believes that the labyrinth is only a portion of the skin with its nerve that has undergone special development. He considers the static sense of the labyrinth a cutaneous tactile sense with a special development, the stimulant being tension and traction on the neuro-epithelium. For the skin the impulses not only cause a sensation of localization of the stimulation, but also motor reflexes which result in automatic coordination of the relation between the stimulant and the point stimulated. Such tactile impulses help in the coordination of equilibrium. He discusses in detail the anatomy of the labyrinth and the mechanism of reactions of labyrinth, and the arguments brought forward show that the chief functions of the labyrinth can readily be explained in harmony with this theory.

Chilow [33] demonstrates the functional relations of the otolith apparatus and the semicircular canals. He feels that as yet not enough anatomic material has been collected to give a correct idea of the form of the otoliths, so that the most that can be said is that the otoliths are calcium deposits which rest on sensory nerve fibers and are welded together by a gelatinous mass. There are several theories regarding this structure and its relation to the canals. Magnus and deKleijn think that the maximum of stimulation of the utriculosaccular nerve is brought about when the otoliths are suspended, which causes traction on the sensory fibers. In this way, they explain the reflexes that are seen on change of position of the animal's body space. But Quix says that the maximum stimulus occurs as a result of increased pressure of the otoliths on the hairs of the epithelium of the nerve and that these changes of pressure may occur not only on change of position of the body, but also with forward movement. The chief difference in the theories lies in the fact that Magnus and deKleijn connect otolith function with reflexes of position, while Quix thinks that they are also related to movement.

Chilow believes that experiments made in the clinic of W. S. Wojatschek have shown that there is another factor in the stimulation, namely, increased labyrinthine pressure. The increase in pressure was

31. McNally, W. J.: Arch. f. d. ges. Physiol. **213**:673, 1926.
32. Mygind, S. H.: Ann. d. mal. de l'oreille du larynx **46**:453, 1927.
33. Chilow, K. L.: Ztschr. f. Hals-, Nasen-u. Ohrenh. **17**:485, 1927.

brought about by pressure on the round and oval fenestra and by the stimulation of the otoliths judged by the deviation of the eyes. Wojatschek performs ingenious experiments and shows that no specific factor, such as dependent position or pressure of the otoliths, is necessary for stimulation of the endings of the utriculosaccular nerve, but any mechanical action on the sensory hairs is sufficient to produce it. Chilow also performed a series of experiments by centrifugalizing mice, which showed that the otoliths react not only to change of position and forward movements, but also to rotary movements. These numerous experiments further confirm the theory that stimulation of the otolith system causes a reaction of the semicircular canals and that otolith function has an influence on the reflexes of the semicircular canals.

DeNo [34] reviews the work of other authors in discussing the foundations of the physiology of the labyrinth. He considers the various theories by Mach-Brewer which have been most generally accepted and the most recent theories of Magnus, Quix and others. In regard to the mode of stimulation of the organs of the labyrinth, DeNo says that it is neither the gliding action of the otoliths (Brewer), the traction (Magnus) or pressure (Quix) which produces the stimulus, and that pressure conditions in the labyrinth in general do not play any part in its functions. He experimentally showed that changes in pressure alone do not cause stimulation in the labyrinth. It is necessary that the fluid in the labyrinth or the membranous labyrinth should move in order to produce stimulation.

Further experiments by the author lead him to conclude that it is changes in the form of the otolith membranes that cause movement of the hairs of the hair cells and stimulate the macula. It is obvious that on any movement of the head the otolith stones, on account of their greater weight, will change the form of the otolith membranes. When the movement stops, the otolith membrane returns to a position of equilibrium, so the otolith organs are stimulated not only by movements of gravity, but also by all other movements (progressive movements, rotations, etc.). So much for the otolith apparatus. Now as to the method of stimulation of the crista of the semicircular canals, it is evident that any movement of the head will cause a movement of the endolymph inside the membranous semicircular canal, and also inside the bony canal and the perilymph. This produces the forces which act on the cupula. Nothing is known at present of these forces. DeNo reviews the various theories of these forces, but his own experiments confirmed Bárány's theory that when a part of the fluid of the labyrinth is heated or cooled it flows upward or downward because of its decreased or increased weight, which causes a current in the semi-

34. DeNo, R. Lorente: Skandin. Arch. f. Physiol. **94**:251, 1926.

circular canals and so stimulates the cristae. DeNo believes that the stimulation of the nerve terminals of the semicircular canals is brought about by three factors: (1) the movements of the perilymph, (2) the movements of the endolymph and (3) shifting of the position of the membranous semicircular canal. This article is highly recommended to those who desire the full details.

In a lengthy article, Thornval [35] describes his experimental studies on the function of the semicircular canals and that of the otoliths, and, without attempting to enter into the description of these experiments, it will suffice to say that this work tends to show that contrary to "revolutionary modern communications" caloric nystagmus originates in the semicircular canals. In a second part of this prodigious experimental work, Thornval has tried to show the correlation which exists between the semicircular canals and the function of the otoliths. It appears that the suppression of the function of a canal has some action on the otolith apparatus, and he states that the otoliths play a rôle in the appearance of nystagmus only in collaboration with the semicircular canals. This is demonstrated by his study of lateral positions, in which he finds the tonus of the different canals varying with these positions.

THE POINTING, CALORIC AND FISTULA TESTS

Wodak [36] gives a long summary on the physiologic observations and clinical method of Bárány's pointing experiment. He includes practically all symptoms which may influence the pointing reaction, such as reflex effects on the musculature of the pointing arm by another muscle group, the effect of skin stimuli, the spontaneous deviation reaction, rotation of the head, turning of the eyes and other symptoms. Special stress is laid on the tempo of pointing. A detailed analysis of the pointing reaction after rotation and calorization is given.

He discusses also the outcome of the pointing experiment in persons who know about the deviation reaction. Wodak prefers to have the patient sit in front of him with eyes closed, both hands stretched out in front, horizontally with the shoulder. The observer sits in a corresponding attitude with his hands opposite to, but without touching, the hands of the patient. He then directs the patient to move his hands down and up. By this method, Wodak is able to estimate the error that normally occurs. He warns that great caution is necessary in interpreting this test in diagnosis, as it is impossible for it to accomplish what was expected of it in the beginning.

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35. Thornval, A.: Copenhagen 157, abstr. in Arch. internat. de laryngol. otol. and rhinol. **33**:1015, 1927.

36. Wodak, E.: Monatschr. f. Ohrenh. **60**:1011, 1926.

Leisse's [37] experiments with the caloric test seem to substantiate Frenzel's theory that there is a bridge of bone connecting the posterior wall of the auditory canal with the lateral curvature of the horizontal semicircular canal which transmits the cold wave to the labyrinth. The author was unable to produce horizontal nystagmus by cold douches on the side of the subject, the lower ear faced at an angle of about 30 degrees to the ground. Douches of the upper ear when the patient's head was so placed that the ear was 30 degrees to the upper shoulder also failed to produce horizontal nystagmus. Change of position of the head produced horizontal rotary nystagmus in both instances.

These observations are compatible with Bárány's theory of a current in the endolymph, but not with Kobrak's theory of transmission by the blood vessels. They cannot be explained by an action of the otoliths either, for these results cannot be obtained in the cavities of radical mastoid operations, which shows that it is necessary for the posterior wall of the canal to be intact.

Hinsberg [38] describes the fistula symptom in the sequestrum of the labyrinth. Ruttin was the first to describe the so-called fistula symptom. He called attention to the fact that when the density of the air in the auditory meatus is increased or decreased, nystagmus or deviation occurs if the increased or decreased pressure is transmitted to the fluid in the labyrinth through a hole in the bony wall of the labyrinth. This is probably true for the majority of cases, but Uffenorde says that the fistula symptom can be produced not only in this way, but even in sequestration of the labyrinth and destruction of the semicircular canals by pressure or traction on the nerve trunk or its branches. Hinsberg describes a case which he thinks supports Uffenorde's theory; a man, aged 23, in whom a sequestrum of the labyrinth was found, had a marked fistula symptom.

Ramadier [39] takes up the subject of fistula of the labyrinth in all its details. This article is one of the best that has come to my attention on the subject. The various theories as to how this symptom is produced, the clinical application and differential diagnosis are capably discussed.

Fistula of the labyrinth may form from within outward, but this occurs rarely if at all. As a rule, fistula develops in the course of a chronic otitis, and generally a cholesteatomatous otitis. The horizontal canal is the favorite site, and two fistulas may occur in the same labyrinth. The author describes the possible degree of involvement and gives a full account of the symptomatology.

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37. Leisse, O.: Arch. f. Ohren-, Nasen-u. Kehlkopfh. **116**:56, 1926.
38. Hinsberg: Ztschr. f. Laryngol. Rhinol. **15**:137, 1927.
39. Ramadier, J.: Ann. d. mal. de l'oreille du larynx **46**:248, 1927.

The signs of fistula are not always present, neither can they always be induced. They may be absent in one test and present in another.

Compression of the vessels in the neck (Mygind's test) may produce nystagmus generally directed toward the side opposite the fistula; release of pressure generally stops it, but one of lesser intensity may appear in the opposite direction. Vertigo or nausea rarely occurs during the compression test.

Mygind's sign is positive in 66 per cent of the cases of fistula, while the pneumatic test is positive in 85 per cent; its value lies in the fact that it is positive in some cases in which the pneumatic test is negative. When present, Mygind's sign is pathognomonic of fistula of the labyrinth, except in cases of hereditary syphilis.

Spontaneous nystagmus is seen in about one half of the cases of fistula; it is variable in character and is directed to either the normal or the diseased side, or is variable from time to time.

The caloric reaction is normal in more than one half of the cases; the rotary reaction is normal in the majority of cases. The electrical reaction is intact, as a rule, and is generally hyperexcitable.

The diagnosis of fistula of the labyrinth is based chiefly on the pneumatic test, but the test is found in other conditions than fistula of the labyrinth.

Pallestrini [40] studied the so-called paradoxic reaction of the vestibule. In his clinical and experimental work, the author found that in a considerable number of lesions of the labyrinth there is that special form of dissociated nystagmus known by the name of paradoxic reaction, which is due to persistence of the postrotary reaction and the abolition of caloric stimulation. It may have various causes: acquired syphilis, traumatism, toxic and infectious conditions involving the ear and sclerosis of the labyrinth. Such changes are generally permanent, and for that reason paradoxic reaction is particularly valuable in making a prognosis.

Buys [41] gives a report of three cases in which the reaction to the caloric test of the vestibule with cold water (27 degrees) was abnormal, as the heterolateral nystagmus which is produced normally in the optimum position was not reversible with forward inclination of the head. In his cases, the author was able to demonstrate that a heterolateral nystagmus can be produced with cold water with the head bent forward.

Ferreri [42] states that the caloric test is much more effective in showing lesions of the vestibule than the rotation test. Spontaneous vertigo

40. Pallestrini, E.: Rev. oto-neuro-oftalmologica **3**:633, 1926.
41. Buys: Arch. ital. di otol. **37**:440, 1926.
42. Ferreri, G.: Rev. oto-neuro-oftalmologica **3**:563, 1926.

is not directly proportional to that caused by caloric stimulation or by rotation. Vertigo can be produced by electricity when it cannot be elicited by caloric stimulation or rotation. When there is spontaneous nystagmus in a patient with a lesion of the head, it means that there is a serious lesion of the vestibule. There is always spontaneous vertigo in lesions of the hypophysis. Dissociated provoked nystagmus, or absence or decreased amplitude of its rapid component, is important in the diagnosis and localization of extralabyrinthine or supranuclear lesions. In lesions of the nerve trunk, the vestibule is more easily injured than the cochlea.

Baldenweck [43] gives a general review of the clinical value of vestibular nystagmus in peripheral diseases of the labyrinth. He takes up the various clinical methods in use for labyrinth stimulation, confining himself to the practical phases of the subject already known.

Spontaneous nystagmus of peripheral vestibular origin has special characteristics and a course of evolution that make it possible to distinguish it from spontaneous central nystagmus, particularly in unilateral diseases.

Nystagmus brought on by movements of the head should be studied systematically. Rotary nystagmus (after rotation in chair) may be divided into: (*a*) hyperexcitability, which as a rule is due to central disease; (*b*) hypoexcitability, which in itself does not make a diagnosis of localization possible, and (*c*) Ruttin's compensation signs, which indicate death of the peripheral labyrinth of a relatively old date.

The caloric, electrical and pneumatic tests relative to nystagmus are reviewed.

This is not a complete review of all the articles published within the specified period on the subject of anatomy and physiology of the ear. Many articles which were available were omitted because they did not lend themselves properly to a brief review, or because they did not add to the existing knowledge on the subject.

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43. Baldenweck, L.: Rev. -d'oto -neuro-ocul. **5**:401, 1927.

News and Comment

NEW OTORHINOLARYNGOLOGIC CLINIC OF THE FACULTY OF MEDICINE AND THE HOSPITAL DE STRASBOURG

A postgraduate course in otorhinolaryngology will be given under the direction of Prof. George Canuyt from Monday, July 2, to Saturday, July 14, 1928.

AN INQUIRY INTO DEATHS FROM LOCAL ANESTHESIA

Dr. Georges Canuyt, professor of clinical otorhinolaryngology at the Faculty of Medicine of Strasbourg, requests physicians and specialists in otorhinolaryngology who have observed, or who have knowledge of, deaths occurring during the course of local anesthesia, kindly to communicate them to him by replying to the following questionnaire:

1. Characteristics of the patient (sex, age, etc.).
2. From what condition was the patient suffering?
3. What operation was contemplated?
4. Did death occur before, during or immediately after the intervention?
5. Under what conditions did the accident occur?
   - (*a*) Anesthetic employed.
   - (*b*) Dose, concentration.
   - (*c*) Mode of application (painted on or injected).
6. What symptoms were observed?

Professor Canuyt wishes to thank in advance the confrères who will be so kind as to write him, and agrees to hold strictly secret the names of those who write. Replies should be addressed to Professor Canuyt, Clinique oto-rhino-laryngologique, Hôpital Civil Strasbourg, France.

Abstracts from Current Literature

Ear

Acoustics and Audition. A. Bonain, Arch. internat. de laryngol. otol. rhinol. **6**:969 (Sept.-Oct.) 1927.

The author discussed physical differentiation between resonant vibrations of ponderable bodies and aerial acoustic waves at length. The vibrations which ordinarily reach the ear are those of the latter type. Their mode of propagation is by concentric spheres, but the acoustic waves are the radii of these spheres. The acoustic wave vibrates in a longitudinal manner in contradistinction to the ether waves the vibrations of which are accomplished transversely. They possess amplitude, frequency, rhythm and duration, and they are subject to reflection, refraction, diffraction, interference and filtration.

In the normal state these waves reach the ear by the route of least resistance, the aerotympanic. The tympanic membrane, round window, and basilar membrane offer little resistance to their penetration. These waves reach the tectorial membrane, which acts as a resonant vibrator to communicate the vibrations to the hair cells. The cellular perceptions are then transmitted to the brain to become sensations of resonance. The amplitude of the vibration gives one the notion of intensity, the frequency that of tone, the combination of frequency and rhythm accounts for the timber and the duration of the vibrations creates the impression of continuity.

The membrane of the tympanum, the ossicular chain and muscles, the round window and the footplate of the stapes in the oval window form an accommodating apparatus of hearing. The disappearance of the tympanic membrane, ossicles or the closure of the round window does not destroy hearing but only limits its capacity. The posterior recess of the tympanic cavity constitutes a gaseous lens, the pressure of which is slightly above that of the external air, and refracts the acoustic waves which traverse it. Depending on the action of the ossicular chain with its muscles and the action of the tympanic membrane, the two faces of this lens may be either biconvex or biconcave to converge waves of weak amplitude or to diverge those of too great amplitude and penetration.

Influence of the Irritation of the Otoliths on the Reflexes of the Semicircular Canals. C. Z. Chiloff, Rev. de laryngol. **48**:691 (Nov. 30) 1927; 721 (Dec. 15) 1927.

The literature of ampullar and otolith nystagmus was reviewed and discussed. The conclusions that the author drew from his review were: 1. The changing of the position of the head in space is the specific excitant of the otolith apparatus. 2. The diagnosis of the so-called isolated conditions of the otolith organ is not definitely nor clearly marked. 3. The semicircular canals and the vesicle of the vestibule simultaneously contribute to caloric compression and postrotary nystagmus.

Sixty normal persons were tested in the Bárány chair with the eyes closed and the head forward, so that the frontal canal was in the plan of rotation. The patients were turned ten times in twenty seconds, and the duration and character of the nystagmus were noted. After an interval, the patients were again turned in the same direction, but at the termination of the turning the head was raised to the vertical position. In 95 per cent of the cases, the nystagmus was shortened by the change in position of the head. As some authorities contend that the shortening of the nystagmus was due more to the neck reflex than to the otolith organ, the author placed cats in plaster casts and repeated the experiments, with the same results.

In order to destroy the function of the otolith membrane, cats were placed in a centrifuge and turned at the rate of from 1,000 to 1,200 revolutions a minute. The experiment was then repeated after three days. It was found that changing the position of the head did not have any influence on the nystagmus. The labyrinths of the cats were sectioned, and the specimens showed the otolith membrane detached.

In order to measure the amount of past pointing and deviation in falling, or what the author called body nystagmus, he devised a system of scales. The patients were submitted to turning with the head in a forward position. The falling and past pointing were feeble in 94 per cent and medium in 6 per cent. On raising the head, however, to the vertical after turning in the lowered position, he found that the reactions were feeble in 32 per cent, medium in 34 per cent and strong in 34 per cent.

The author concludes that the otolith membrane shackles to ocular nystagmus of the semicircular canals but increases the body nystagmus.

ROTH, Kankakee, Ill.

VERTIGO. F. LEIRI, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:139 (Aug. 27) 1927.

The exhaustive contribution of Leiri concerns: (1) the peripheric organs in relation to the perception of postrotatory vertigo; (2) the significance of the reflexes elicited from the horizontal semicircular canals, during turning, and their relation to the innervation of the equilibrium; (3) the reflex static innervation and some phenomena of vertigo, and illusions caused by the same; (4) altitude dizziness.

The essay must be read in the original, because the space allotted to an abstract cannot do justice to the article.

HISTOLOGY OF DEAFMUTISM AFTER SCARLET FEVER MENINGITIS. GERALD RUEMBLE, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:195 (Aug. 27) 1927.

The author describes the histologic changes in two cases of deafmutism which occurred after scarlet fever. The middle ear was normal in both instances. The two patients showed the symptoms of deafmutism caused by meningitis. Therefore, the conclusion was permissible that scarlet fever meningitis caused the deafmutism at a time when a malignant epidemic of scarlet fever occurred. The osseous obliteration of the labyrinth corresponded with the pictures observed in deafmutism after cerebrospinal meningitis, meningitis after measles, meningotyphoid fever, etc. The first patient, a woman, aged 71, had been admitted to the clinic, Oct. 6, 1920, suffering from a diffuse bronchitis, and died on October 17. At the age of 3 years, the patient had had meningitis after scarlet fever and had lost her hearing entirely. The second patient, a man, aged 58, was admitted to the surgical clinic on May 8, 1920, on account of tuberculosis of the ileocecum. He died, October 15, with the symptoms of thrombosis of the vena cava which was verified by necropsy. At the age of 9, the patient had become totally deaf following scarlet fever.

AMBERG, Detroit.

Nose

TREATMENT OF ATROPHIC RHINITIS BY IVORY IMPLANTS. HARRY L. POLLOCK, Ann. Otol. Rhin. & Laryng. **36**:241, 1927.

The greatest factor in keeping up the well known symptoms of atrophic rhinitis is an abnormally large intranasal space. Whether all of these symptoms, such as crust formation, stuffiness of the nose, foul smell and a discharge, with secondary involvement of a pharyngitis or laryngitis sicca, are due secondarily to a sinus infection, a dysfunction of the endocrines secondary to a hypertrophic rhinitis or any other cause, the fact remains that as long as the abnormally large intranasal space is present, the symptoms continue unabated. To overcome this the Halle and Lautenschlager opera-

tions have been devised, the idea being in both cases to lessen the space by attempting to bring the lateral walls of the nose toward the septum. Pollock's results with these operations have not been entirely saisfactory. He has had much better success by forcing the septum toward the lateral wall. This is accomplished by means of intraseptal implants, placing them under the mucoperichondrium and thus forcing the outer septal wall toward the lateral nasal wall. Pollock started this work even before the Halle or Lautenschlager operations were presented, his first attempts being with inlays of paraffin and later with fascia lata. The former soon sloughed out, and the latter contracted to such an extent that it was scarcely discernible. He next used bone and cartilage from a previously operated septum resection. This was successful but not easily obtainable, as it usually required two septums to fill up one side of an atrophic rhinitis space, and it was often impossible to obtain all three cases at the same time. Cartilage or bone from the patient himself, taken from the rib or tibia would occasionally become infected and the transplant would be lost.

The difficulties experienced with these various materials have been greatly overcome by the use of ivory. The ivory used is that from the tusks of the elephant and is obtained in large pieces. It must be cut and shaped by the surgeon himself to fulfil the needs in each individual case. The author warns against employing too much and also stresses the importance of rounding off the sharp corners. A number of small perforated ivory implants are prepared, ranging from one-half (1.27 cm.) to one and one-half inches (3.81 cm.) in length, from one-fourth (0.63 cm.) to one-half inches in height, and from one-eighth (0.31 cm.) to one-fourth inches in thickness. They are sterilized by boiling. A small incision is made in the mucocutaneous border, and the mucoperichondrium is carefully dissected as in an ordinary submucous resection. Special care must be taken to preserve the flap in order to avoid infection. The dissection should be carried well to the floor of the nose as the greatest amount of atrophy occurs at this point. The implants are slipped through the opening, and a small splint or pack is placed over the incision until the following day. Sutures may be inserted as desired. The reaction which follows is extremely slight.

The author urges the thorough exenteration of the ethmoid cells in all cases, as atrophic rhinitis is always associated with chronic suppurative ethmoiditis and sometimes with chronic suppuration of the antrum and other sinuses. The infection in all such cases must be eradicated previous to attempting the implant, and it is best to wait at least six weeks between the two procedures. When the ethmoids are exenterated, it is necessary to leave the middle turbinates intact.

SNAPP, GRAND RAPIDS, MICH.

QUECKENSTEDT TEST IN THROMBOSIS OF THE SINUS AND JUGULAR VEIN. RENE GAILLARD and RENE MAYOUS, Rev. de laryngol. **48**:700 (Nov. 30) 1927.

The Queckenstedt test was discussed as to what should be expected in thrombosis of the lateral sinus and jugular vein. Four cases were reported. In the first case the test was positive, but the sinus was normal; in the second case the reaction was negative, but the sinus was thrombosed; in the third case the test was positive and the sinus was normal, but a perisinus abscess was found; and in the fourth case the reaction was positive, and the pathologic process was removed from the lateral sinus. Two weeks later the test was negative, showing how quickly the collateral circulation is reestablished. Autopsy showed thrombosis of the cavernous sinus, but the jugular vein was normal.

The author is of the opinion that the test may be of value when all other signs fail. He believes that in order to get more reliable data the test should be routine in all cases of otites in which spinal puncture is necessary.

ROTH, Kankakee, Ill.

HYPOPHYSIS EXTRACT IN THE THERAPY OF VASOMOTOR RHINITIS. CORNELIUS VEITS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:132 (Aug. 27) 1927.

The favorable effect of extracts from the middle and posterior lobe of the hypophysis in the treatment of patients with vasomotor rhinitis and hay-fever can be explained comparatively well — perhaps even better than the proved effect in a related disease, namely, bronchial asthma. Saenger and Citelli introduced the use of the hypophysis extract in rhinology, in 1913, as a hemostatic. In reflex neuroses of the nose, the swelling of the mucous membrane, hyperemia, edema and secretion decrease after treatment with hypophysis extract, and the nose becomes permeable. Thus, sneezing ceases, because Killian's spots do not touch one another any longer. The simultaneous use of calcium seems to have a favorable effect. This may be brought about by the repression of diuresis. Calcium is thus retained for a longer time in the body. A single dose of hypophysis extract can be effective for days. Pankow observed in rabbits a slowing of the pulse which lasted for several days after a single injection of pituitary extract. Veits treated six patients suffering from vasomotor rhinitis and two suffering from hay-fever; of the former, one was cured, three were much improved, one was a little improved and one did not show any improvement. The two patients suffering from hay-fever were almost entirely free from symptoms in the summer, 1926. The author tried hypophysis extract also in acute infectious coryza on himself, without noticing any effect. The following secondary effects were noticed: once a premature menstruation and once a collapse, but he was not sure that the latter was caused by pituitary extract. After an injection of hypophysis extract one patient with hay-fever experienced a peculiar dreamlike condition of general fatigue and weakness, with a paralysis of the will, which lasted for about one hour. Hypophysis extract is known to be an analeptic for the heart. Therefore, it was not accidental that collapse caused by cocaine was not noticed when hypophysis extract was given in order to insure a high grade anemia. The author thinks that this was caused by the fact that hypophysis extract increases the blood pressure. The results of serum therapy in hay-fever have not come up to expectation. Mackenzie, Alberts, Heymann, Wolff-Eisner and R. Hoffmann have called attention to the part which the hyperplasia of the thyroid gland plays in hay-fever, and they have established a probable connection with exophthalmic goiter. In favor of such a view may be quoted the blood picture (lymphocytosis, eosinophilia) and the results of thyroid therapy, whether it consists of antithyroidin, thyroidin or iodine in small doses. Heymann had observed the disappearance of hay-fever after strumectomy which was performed for other reasons. Not every vasomotor rhinitis is caused by hypersensibility toward protein. In America, true hay-fever exists, caused by the species Solidago and Ambrosia. Spain calls the complex of symptoms corresponding to hay-fever "atopic coryza." It is caused by various protein bodies. The borderline between vasomotor rhinitis and hay-fever is not distinct. The nervous-hormonal and the anaphylactic form of vasomotor rhinitis must be differentiated, although anaphylaxis may be only an expression of a nervous-hormonal disturbance. Two kinds of the anaphylactic form exist. The etiologic factors of one are all kinds of allergens, any kind of protein bodies and the miasmas described by Storms van Leeuwen. The others originate from focal infections of the teeth, tonsils and accessory sinuses. Riccitelli and Franchini see in anaphylaxis only the exciting effect of spastic rhinitis, and the cause in tuberculosis of the glands or syphilis, which produces vagotonia and spasmophilic diathesis. They believe that mercury and tuberculin are the only remedies, yet French authors obtained good results with peptone and autoserum. Veits asserts that it is irrelevant where the pathogenic chain is broken. This can be done by hypophysis extract, although it is only a symptomatic remedy and may not work in all cases, because the etiology, the point of attack of the remedy and the response of the organisms vary.

CONSERVATIVE SEPTUM OPERATION, CLINICAL AND EXPERIMENTAL CONTRIBUTION. N. A. PAUTOW, Ztschr. f. Hals-, Nasen- u. Ohernh. **19**:219 (Oct. 28) 1927.

In the modern treatment of deformation of the septum, old ideas have come to the front again. They have appeared in a new form and are carried out with a new technic. The question arises whether or not too much of the septum is removed in Killian's operation. In atrophic rhinitis, or, in latent inclination toward this condition, Killian's radical operation is not indicated. A firm nasal septum is necessary when a simultaneous correction of deformites of the external part of the nose is desired. This is not possible with Killian's operation. Various intranasal operations require only mobility of the septum in order that a better approach to the field of operation may be obtained; for instance, West's operation. The classic Killian's operation cannot be accepted as a universal operation in deformities of the septum. More conservative measures have been suggested; for instance, implantation of excised cartilage. Experiments on animals have shown that excised and replaced cartilage does not produce new cartilage, and that it is resorbed. The other principle of conservative surgery is exemplified by the methods of detachment of the mucous membrane only on one side, and by the removal of none of the skeleton of the septum, or of only parts which are deformed, or which must be removed in order to preserve the size of the septum. The greater part of the skeleton, and especially the cartilaginous portion, is mobilized by incisions and fractures but remains connected with the mucous membrane of the opposite side. It is placed in a perpendicular position. This method has been used in the clinic of Wojatschek for ten years. The conservative procedure requires expert technic. Four types of operations should be named. 1. Mobilization: After detachment of the mucous membrane on one side, the quadrangular cartilage is repeatedly incised without penetrating the mucous membrane and perichondrium of the opposite side. The skeleton is fractured in proper places with the chisel, sometimes with Killian's speculum. A mobilized septum results which can easily be shifted to the opposite side in order to obtain a better approach to the lateral wall of the nose for intranasal operations. After a time, the nasal septum becomes rigid again. 2. Redressment: The mobilization can be done on the straight septum; the redressment has as its aim the straightening of deflections. The deflections are incised and fractured submucously, but left in connection with the mucous membrane on the opposite side. The septum is then shifted to the middle line and fixated in this position. 3. Circulary resection: This operation is performed in deflections of the cartilaginous portion of the septum. According to the principle mentioned before, two concentric circular incisions are made in the cartilage. The ring created in this manner is detached also from the mucous membrane of the opposite side and excised. The central portion of the cartilage (the disk) remains, and can be shifted into the desired direction and fixated in this position. 4. The partial resection is a further development of these modifications. If it appears that the combination of the circular resection and redressment does not insure a sufficient straightening of the septum, the spurs and spines are separated from the mucous membrane of the opposite side and removed. The combination of one of the three methods with partial removal of some parts of the skeleton is called partial resection.

The author performed 106 resections of the septum in the year 1925-1926, sixteen according to the technic of Killian, and ninety according to that of Wojatschek. The incision in the mucous membrane was not stitched. Packings were introduced into both nostrils. The packing was left for twenty-four hours in the side with the intact mucous membrane and for forty-eight hours in the other. For one or two days, cotton plugs were placed in the nostrils.

Follicular tonsilitis was observed five times. In one instance, angina was complicated by appendicitis. The swelling of the septum lasted for from seven to nine days. With some patients, the swelling persisted. In two instances, the redressment was done on patients suffering from unilateral ozena and a pronounced deviation of the septum in order to narrow the nasal cavity affected by ozena (method of Mermod). Wojatschek states that the nasal septum remains movable for a few weeks.

Experiments were carried out on pigs. They have massive septum and sufficiently wide nostrils. The experiments were as follows: (1) resection of the cartilage according to the method of Killian; (2) resection of the cartilage with reimplantation (the implant was left between the lamellae of the mucous membrane); (3) separation of the mucous membrane from one side of the septum; (4) detachment of the mucous membrane on one side of the septum, incisions and fractures of the cartilage reaching to the mucous membrane on the opposite side (mobilization or redressment).

Histologic investigations were made six months later. Investigations after mobilization or redressment in the pig showed that the septum had become entirely firm and elastic and consisted of an uninterrupted cartilaginous structure, viewed macroscopically. Yet, the cross-cut showed that the incisions in the cartilage were filled with perichondrium which was connected with the perichondrium which covered the cartilage of the septum. To a certain degree, the cartilage of the septum possessed the faculty of regeneration from the perichondrium. This faculty was not pronounced, and negligible from a practical point of view. Fractures of the bone healed after six weeks, but the incisions and fractures of the cartilage did not show any callus even after six months.

AMBERG, Detroit.

Miscellaneous

FOLLICULAR CONJUNCTIVITIS IN RELATION TO THE VEGETATIVE NERVOUS SYSTEM. LODDONI, Ann. di ottal. e clin. ocul. **55**:173, 1927.

The author takes up the question as to whether so-called follicular conjunctivitis is a distinct clinical entity, or whether, as some authors have claimed, it represents a mild form of trachoma. Although typical cases may be easily distinguished by the absence of inflammatory changes involving the connective tissue, of scarring and of corneal lesions in follicular conjunctivitis, and by the fact that its contagious nature has never been proved, still there are cases in which a clinical distinction is impossible and in which even histologic observations do not give a clear-cut distinction. The author examined thirty-one children between the ages of 5 and 8 years, all of whom had follicular conjunctivitis, to determine whether or not anything in the general condition of these children was responsible for the disease. Besides being tested by the Pirquet and Wassermann tests, all of the children were examined especially to ascertain the state of the vegetative nervous system. The pulse rate, respiration, blood pressure and oculocardiac reflex were recorded after injections of epinephrine, atropine and pilocarpine. As regards the ocular condition, most of the patients showed merely the presence of follicles, while a few showed also some conjunctival hyperemia and secretion, and in one case enough hypertrophy was present to make it resemble trachoma. All of the children recovered within a short time without the occurrence of permanent changes. The children were nearly all in robust health, and neither syphilis nor tuberculosis could be considered a factor. Nearly all showed hypertrophy of the lymph nodes elsewhere, especially of the cervical and inguinal glands, in other words, were of the lymphatic type. While it is possible that the conjunctival folliculosis was only another manifestation of the general lymphatic hyperplasia, a constant relationship was not present between the degree of hyperplasia and that of folliculosis. When tested with the three drugs mentioned, the reactions to epinephrine were slight and inconstant, those to pilocarpine within the limits of normal, while all showed a markedly positive reaction to atropine, a slowing of the pulse of over twenty beats, due to paralysis of the parasympathetic nerve endings. All these children, therefore, could be considered of the vagotonic type, and this was borne out by the relative frequency of a markedly positive oculocardiac reflex, that is, a slowing of the pulse of more than ten beats following pressure on the eyeball.

The author concludes that follicular conjunctivitis is independent of syphilis, tuberculosis and other pre-existing ocular disease. It is possible that at least

some cases are attenuated forms of trachoma; this is borne out by the relative mildness of trachoma itself in infants. The only constitutional factors having any bearing on the condition were found to be the tendency to lymphatic hypertrophy and the fact that all cases belonged to the vagotonic type. The fact that Angelucci had found a predominance of this type in cases of trachoma suggests that the constitution may be a factor in both diseases (bibliography).

GIFFORD, Omaha.

Society Transactions

SECTION ON OTOLOGY AND LARYNGOLOGY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA

Regular Meeting, Nov. 16, 1927

JAMES A. BABBITT, M.D., *Chairman*

THE DEMONSTROCOPE. DR. ROBERT LUKENS.

Dr. Lukens demonstrated a device which makes possible the simultaneous viewing of the larynx by two observers in addition to the operator.

CERTAIN LARYNGEAL CONDITIONS. DR. WILLIAM V. MULLEN (by invitation).

The present tendency is to make accurate physical and pathologic laryngeal diagnoses but to neglect the physiologic aspects of the larynx. Adduction and abduction are confusing; constriction and dilation would be better terms. More notice should be given the accessory respiratory muscles in the performance of these functions. The works of Negus and Mosher have proved that the epiglottis does function in the act of swallowing, and Dr. Mullen has observed that dysfunction follows its removal.

The recurrent laryngeal nerve is practically never involved by disease of the thyroid unless the disease is of a malignant nature. This is accounted for by the fact that the laryngeal nerves are well protected in the groove in which they pass to the larynx.

Slides were shown illustrating the variations of laryngeal innervation. Dilworth found that the inferior branch of the superior laryngeal nerve may pass through a foramen in the thyroid cartilage and may have a close anastomosis with the recurrent laryngeal nerve. The arytenoideus muscle is supplied by both the superior and the laryngeal nerves. Negus emphasized that this muscle is concerned in closing the larynx. Probably this is a big factor in glottic closure after section of the recurrent laryngeal nerve. It is probably not quite correct to consider the superior laryngeal nerve entirely sensory with the exception of the motor fibers to the cricothyroid muscle. Any injury or stimulation of the recurrent laryngeal nerves brings the cords to the midline, where they remain until atrophy of the muscles takes place. The term "cadaveric position" is a misnomer, for the cords do not take this position after death. Dilworth considered the laryngeal nerves as a highly specialized vagus plexus especially assigned to the larynx.

Different observers have obtained different results from experimental stimulation of the recurrent laryngeal nerves. Some have obtained adduction and others, abduction of the cords. These variations were due to different strengths of stimuli. Dr. Mullen felt that conclusive work of this type must be performed on monkeys, as the larynx of the dog varies too much from the human larynx to allow comparison. Some workers have obtained splendid results by anastomosis of the recurrent laryngeal nerve with the phrenic nerve. Reverse results have also been secured. This seems to be due to a lack of control of the amount of stimulus applied.

Three cases were cited. In the first, relief of closure of the glottis was not obtained by ligation of the recurrent laryngeal nerve in a woman who had tight closure of the cords after thyroidectomy. In the second case, the vagus was ligated during a ligation of the thyroid. In this case, the cord went to the outer side. A third patient became aphonic the day after opera-

tion on the thyroid. Both cords were found to be midway between abduction and adduction. Esophageal paralysis also was present. Recovery followed after the patient was fed for ten days by means of a tube. In addition to these cases, three cases were mentioned in which pulmonary atelectasis occurred after injury to the recurrent laryngeal nerve during operation on the thyroid gland.

DISCUSSION

Dr. Albert T. Brubaker: In reference to the respiratory function and its manner of performance, there must be little resistance offered to air in its passage into the lungs. Phonation depends on cutting off the upper portion of the larynx from the lower portion. The vocal membranes must be widely separated to allow the air free passage. The area of the open glottic chink is about 160 sq. mm., which is less than the area above and below. Therefore, some resistance is offered at this point, which varies as the square of the area above. The posticus muscle is much larger than the laterals. This gives rise to the erroneous idea that more power is required to turn the vocal processes out. The posticus muscle does nothing more than separate the vocal cords, and the large size is not necessary. In order for suffocation to be prevented, the vocal membranes must be abducted at all times. This probably explains the large size of the posticus muscle. Only certain parts of this muscle work at certain times, during which periods the unused fibers recover from fatigue.

Each muscle must have its own innervation from special nerve cells. In the upper portion of the medulla is that group of cells which acts as the respiratory center. In addition, the larynx constantly receives impulses through the recurrent laryngeal nerve for the purpose of maintaining adequate breathing space. The lateral crico-arytenoid muscles as well as other phonatory muscles have their own nerve centers. When the recurrent laryngeal nerve is split, the posterior crico-arytenoid muscles can be stimulated without affecting the laterals. Confusion has arisen only because the nerves to the various muscles run side by side in close physical union. The arytenoid muscle receives its nerve supply from the superior and recurrent laryngeal nerves of both sides. In the etherized dog, the effects of stimulation vary, depending on the depths of anesthesia and the strength of stimuli.

Dr. Charles Frazier: Concerning the neurosurgical aspects of the larynx, the tracheal collapse described in the literature does not occur, but the condition is due to glottic closure following injury of the nerves. If the inferior thyroid artery is clamped close to the thyroid capsule, the nerve is not in danger. It is most likely to be injured at the isthmus, and this gives rise to immediate or delayed laryngeal paralysis.

In 1924, Jackson had unsatisfactory results in dilation and ventricular cordectomy for the relief of laryngeal paralysis. At this time, I performed a nerve anastamosis in a number of cases. The descendens noni was joined to the stump of the recurrent laryngeal nerve. In all cases the tone of the cords returned, but in none was the improvement sufficiently good to allow decanulation. In the last four patients operated on, the phrenic nerve was used. Three of these operations were anatomically successful; in the fourth, the recurrent laryngeal nerve could not be found. So far, eighteen patients in all have been so treated. In twelve, the descendens noni was used; in four, the phrenic. Sixteen operations were anatomically successful; eight patients were improved; six were not improved, and two were greatly improved.

Dr. Fielding O. Lewis: In two cases of carcinoma, in which I removed the epiglottis, swallowing was accomplished without difficulty. There was trouble at first in training the patients to swallow, but after a feeding tube was used for a few days, they were able to take food fairly well. In one case in which radium was used, the nerves of deglutition were paralyzed. The course of the laryngeal nerves is long, and hence they are exposed to numerous dangers. Often the laryngologist may be of signal aid to the neurologist.

DR. GEORGE B. WOOD: In tuberculosis of the larynx, the epiglottis may be removed in toto or in part either by the cautery or by the disease itself. In these cases, I have not seen the function of swallowing damaged. If the fibers passing through the aryepiglottic folds are not disturbed, dysfunction will probably not occur.

DR. ROBERT J. HUNTER: The human epiglottis is a more or less vestigial structure. In the ruminant, it allows simultaneous eating, breathing and smelling.

OBSTRUCTIVE LARYNGEAL DYSPNEA. DR. GABRIEL TUCKER.

The dyspneic patients, in whom the cause of the symptoms is laryngeal obstruction, show characteristic signs on examination that at once distinguish them from other forms of dyspnea in which there is no obstruction to the larynx. The characteristic sign is indrawing at the suprasternal notch, around the clavicles, the intercostal spaces, and the tip of the sternum on inspiration. These signs are particularly apparent in children with obstructive laryngeal dyspnea. Patients with this type of the disease require surgical treatment, and often emergency tracheotomy or intubation is necessary. The treatment of the other types of dyspnea is essentially medical and is usually not so great an emergency. The administration of morphine and other sedatives in obstructive laryngeal dyspnea, because of its sedative effect on the accessory respiratory muscles and the inhibitory effect on the cough reflex, increases the retention of secretion and the tendency to pulmonary edema. The use of sedatives is therefore inadvisable in obstructive laryngeal dyspnea. The early recognition of the signs of indrawing and the patient's inability to sleep are the indications for surgical relief of the dyspnea. The safest and best treatment for the relief of obstructive laryngeal dyspnea is tracheotomy below the first tracheal ring, under local anesthesia.

In a case of obstructive laryngeal dyspnea due to postdiphtheritic cicatricial laryngeal stenosis, in which the signs of indrawing were marked, tracheotomy was done; the dyspnea was entirely relieved, with the disappearance of the indrawing.

Book Reviews

HANDBOOK OF DISEASES OF THE EAR. By RICHARD LAKE and E. A. PETERS. Fifth Edition. Price, $4. Pp. 310. New York: William Wood & Company, 1927.

The fact that this is the fifth edition of the book is evidence that it has met with a large degree of success as a shorter treatise on diseases of the ear. As is often the case with a book which has been written some time ago, it retains a good deal of material that has since become obsolete in the practice of otolaryngology; such, for example, is the description of the use of the Lucae pressure sound in the treatment of fixation deafness, the recommendation of pneumo-massage and, particularly, the recommendation of this method as the treatment *par excellence* in deafness of the aged, a degenerative condition of the nervous mechanism due to senile changes. The advice, in regard to otosclerosis, that the tonsils "if advisable should be removed and the nasal passages corrected" sounds like those recommendations insisted on when otosclerosis was believed to be a type of chronic catarrhal otitis media and therefore etiologically dependent on conditions in the nose and throat. Too many "tinkering" operations are still being performed in the nose and throat as a treatment in otosclerosis, when, so far as the nose and throat are concerned, definite indications to justify operations do not exist.

In the treatment of patients with chronic suppurative otitis media, the authors adhere to what must be accepted now as an antiquated view that all chronically discharging ears are potentially dangerous, and that therefore when the process cannot be cured by local measures in a reasonable time (six months), it is proper to urge the radical mastoid operation. The separation of patients with chronic suppurative otitis media into two groups, one in which the process may lead to a serious complication, and the other in which such a possibility is negligible, is accurately made today; for obvious reasons, the radical mastoid operation is reserved for the small group of cases in which, because of the recognition of a process that is invading the bone, there exists an actual menace of a possible serious complication.

The authors' interpretation of nystagmus occasioned by using a syringe in treating a chronically discharging ear with "water a little colder or a little warmer than usual" as an indication of a dangerous condition which calls for operative treatment seems unwarranted. This symptom simply indicates that there is a large enough perforation in the membrana tympani to permit the ready development of normal caloric responses. The statement which follows, that this caloric response produces a nystagmus in the horizontal plane, is also incorrect, for if the patient is sitting upright, it is impossible to produce a nystagmus in the horizontal plane by caloric stimulation.

In a chapter on minor operations, the authors discuss "operations for division of the tendon of tensor tympani muscle, division of the posterior fold of the membrane, division of the anterior ligament of the malleus, and division of the stapedeus muscle." To the reviewer, all of these operations seem out of place in view of the present conception of the changes producing the deafness in the conditions which are still designated as chronic adhesive processes of the middle ear. The authors' discussions of operative technic throughout are better than their discussions of the problem of what is more difficult and palpably more important, namely, what constitutes proper indications for these operations.

DISEASE OF THE NOSE, THROAT AND EAR. By A. LOGAN TURNER. Second Edition. Price, $6. Pp. 240. New York: William Wood & Company, 1927.

English physicians will be glad to see the second edition of this excellent treatise on otolaryngology. Each chapter has undergone a revision, and some have even been rewritten. The text is a compilation by several men from Edinburgh.

Dr. A. Logan Turner, in collaboration with Dr. W. G. Gardiner wrote the chapter on diseases of the nose. The section on diseases of the perinasal sinuses was prepared by Turner himself.

It is the aim of the authors to include only such matters as have been definitely established. Each chapter, therefore, is an excellent guide to undergraduate students and to practitioners in the treatment of the diseases of this special field.

Dr. Douglas Guthrie wrote the section on the pharynx and nasopharynx and Dr. J. D. Lithgow, the one on the larynx. The chapter on peroral endoscopy was written by Dr. Ewart Martin. Each of these sections is an excellent presentation of the clinical facts pertaining to these parts.

Dr. J. S. Fraser has rewritten in part the section on the diseases of the ear and gives a clear presentation not only of the established clinical facts of the diseases affecting this organ, but of the pathologic conditions as well, particularly those of the internal ear. The subject is presented clearly because the author thinks clearly and has acquired the faculty of distinguishing readily between such clinical facts as have become definitely established and the pseudoscientific contributions that tend to flood the current literature of a special field like otolaryngology.

A fuller review of the first edition of this book appeared in an earlier edition of the ARCHIVES (**1**:129 [Jan.] 1925).

Directory of Ophthalmological and Otolaryngological Societies

INTERNATIONAL

FIRST INTERNATIONAL OTO-RHINO-LARYNGOLOGICAL CONGRESS

President: Prof. E. Schmieglow, University of Copenhagen.
Place: Copenhagen, Denmark. Time: July 29-Aug. 1, 1928.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman: Frank R. Spencer, 1345 Spruce St., Boulder, Colo.
Secretary: William V. Mullin, Cleveland Clinic, Cleveland.
Place: Minneapolis. Time: June 11-15, 1928.

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Secretary: Dr. R. L. Loughran, 33 E. 63d St., New York.
Place: Raleigh Hotel, Washington, D. C. Time: May 3-5, 1928.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Max A. Goldstein, 3858 Westminster Pl., St. Louis.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.
Place: Raleigh Hotel, Washington, D. C. Time: April 30-May 1, 1928.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Luther C. Peter, Physicians Bldg., Philadelphia.
Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: Hotel Statler, St. Louis. Time: Oct. 15-19, 1928.

LOCAL

THE COLORADO OTO-LARYNGOLOGICAL SOCIETY

President: Dr. C. Howard Darrow, Metropolitan Bldg., Denver.
Secretary: Dr. Harold L. Hickey, Imperial Bldg., Denver.
Place: Assembly Room of Metropolitan Bldg. Time: First Saturday of each month from October to May.

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Chairman: Dr. Walter A. Wells, The Rochambeau, Washington, D. C.
Secretary: Dr. J. N. Greear, Jr., 1740 M St., Washington, D. C.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month.

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Secretary: Dr. Zach W. Jackson, Doctors Bldg., Atlanta, Ga.
Place: Academy of Medicine, 32 Howard St. Time: 8 p. m., last Thursday of each month.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

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Secretary: Dr. Austin A. Hayden, 25 E. Washington St., Chicago.
Place: Grill Room, Stevens Restaurant, 16 N. Wabash Ave. Time: 6 p. m., first Monday of each month from October to May.

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President: Dr. Thomas Hood, Hume-Mansur Bldg., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

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President: Dr. Val H. Fuchs, Chaille Medical Bldg., New Orleans.
Secretary-Treasurer: Dr. Carl E. Granberry, Maison Blanche Bldg., New Orleans.
Place: Senses Hospital, Touro Infirmary, and Charity Hospital (in rotation).
Time: 8 p. m., third Thursday of each month from September to June.

SECTION ON OTOLOGY AND LARYNGOLOGY OF THE BALTIMORE CITY MEDICAL SOCIETY

Chairman: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore.
Secretary: Dr. Waitman F. Zinn, Medical Arts Bldg., Baltimore.
Place: 1211 Cathedral St. Time: 8:30 p. m., last Friday of each month.

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Secretary-Treasurer: Dr. William Fowler, Maccabees Bldg., Detroit.
Place: Maccabees Bldg.. Time: Third Wednesday evening of each month from October to May.

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President: Dr. A. J. Lorie, 409 Commerce Bldg., Kansas City, Mo.
Secretary: Dr. A. E. Eubank, 636 Argyle Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May; the November, January and March meetings are devoted to clinical work.

NEW ENGLAND OTOLOGICAL AND LARYNGOLOGICAL SOCIETY

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Secretary and Treasurer: Dr. Calvin B. Faunce, 320 Commonwealth Ave., Boston.

THE SECTION ON LARYNGOLOGY AND RHINOLOGY OF THE NEW YORK ACADEMY OF MEDICINE

Secretary: Dr. Arthur Nilsen, 40 E. 41st St., New York.
Time: 8:30 p. m., fourth Wednesday of each month from October to May.

THE OTOLOGICAL SECTION OF NEW YORK ACADEMY OF MEDICINE

Chairman: Dr. J. L. Maybaum, 12 E. 86th St., New York.
Secretary: Dr. R. T. Atkins, 4 W. 53d St., New York.
Place: 103d St. and Fifth Ave. Time: Second Friday of each month from October to May.

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President-Elect: Dr. Charles C. Jones, 19 Garfield Pl., Cincinnati.
Secretary-Treasurer: Dr. Harris H. Vail, 24 E. 8th St., Cincinnati.
Place: University Club. Time: 6:45 p. m., second Tuesday of each month from October to May.

THE OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SECTION OF THE CLEVELAND ACADEMY OF MEDICINE

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Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
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Secretary: Dr. Herman B. Cohen, 13th & Spruce Sts., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., first Tuesday of each month from October to June.

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Chairman: Each member, in alphabetical order.
Secretary: Dr. M. B. Selingstein, 801 Union and Planters Bank Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

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President: Dr. Ray K. Daily, Medical Arts Bldg., Houston, Texas.
Secretary: Dr. L. W. Raney, Post-Dispatch Bldg., Houston, Texas.
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Secretary: Dr. A. E. Jackson, Medical Arts Bldg., Fort Worth.
Place: University Club. Time: 6 p. m., first Friday of each month except August.

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President: Dr. Charles J. Coffey, 221 Grand Ave., Milwaukee.
Secretary-Treasurer: Dr. Edward R. Ryan, 425 E. Water St., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

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